

ELECTRICAL CONSTRUCTION AND MAINTENANCE

OCTOBER • 1950

49th Year



LIGHTING 1950

A Progress Report Projected market potentials and opportunities in modern planned lighting based upon the Indianapolis survey. Selected case studies spell out design, method and application considerations.

An Editorial Feature Section

Cash in on this Big Floodlighting Promotion Campaign



"*A Chance to Play*" is a twenty minute movie produced by The March of Time for the General Electric Company. It punches home the advantages of floodlighting recreation areas—making recreation available during the hours of darkness. Showings will be nation-wide.



"*Recreation Is Everybody's Business*" is a deluxe thirty-six page booklet telling community leaders how to plan community recreation centers.



"*Industrial Recreation Is Good Business*" tells industrial leaders the Why, Where, and How of floodlighted recreation.



These ads will be doing a job . . . going to municipal leaders, others to civic groups and fraternal organizations.



Direct mail—to civic associations, police, recreation, athletic directors, etc.

Over \$530,000,000 is being spent annually on organized recreation by communities and industries. Now, a tremendous General Electric promotion is telling these groups that recreational floodlighting increases the benefits of their recreation programs. There's a movie produced by The March of Time for the General Electric Company, two valuable manuals, audience literature, all backed by an advertising and direct mail campaign. It's estimated that over 20,000,000 people will see and hear this General Electric promotion. That means a lot of people, industries and communities, are going to want floodlighted recreation fields. And that's where you can pick up some floodlighting contracts.

Here's how to get your share of contracts

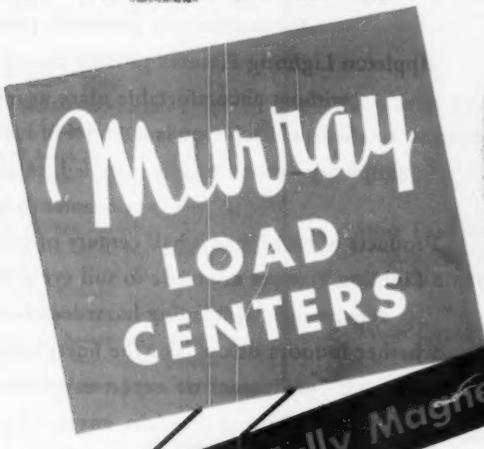
First—to know what's going on and the advantages of recreational floodlighting, contact your G-E distributor or sales office and arrange to see or sponsor this program. *Then*—so you'll have a handy reference for making actual plans and estimates, get General Electric's "Manual of Floodlighting Plans." This manual shows 43 plans—detailed down to lists of material—for all popular outdoor sports. Write for GET-1284C, Apparatus Department, General Electric Company, Schenectady 5, N. Y.



GENERAL ELECTRIC

NEW!

**COMPACT!
ECONOMICAL!**



with Fully Magnetic Circuit Breakers



*That are Interchangeable
with Other New Single Pole
Individually Housed Breakers*

*Shallower
Box —*

*—only 3 inches deep—ideal
for flush installation in "dry
wall" construction. Plus a
simple $\frac{3}{8}$ " plaster line
adjustment!*



*See for yourself why Murray fully magnetic
breakers can't trip from heat... they need
detering... always carry rated load plus
harmless overloads—even in warm locations
and poorly ventilated panels. Clear, simple
diagrams tell the story in this folder. Write
for your copy today.*



MURRAY MANUFACTURING CORPORATION

1250 ATLANTIC AVENUE • BROOKLYN 16, N. Y.

Electrical Safety Device's for Home and Industry

"SEEING EYES"

for PROFITABLE PRODUCTION

Without good clear vision on the job, even the most skilled production worker falls short of top performance.

That's why good lighting equipment is a basic essential for consistently profitable production.

Appleton Lighting Fixtures provide the *right* light, without uncomfortable glare, troublesome contrast or shadow. Each type is a model of mechanical simplicity—economically installed, easily wired, conveniently serviced.

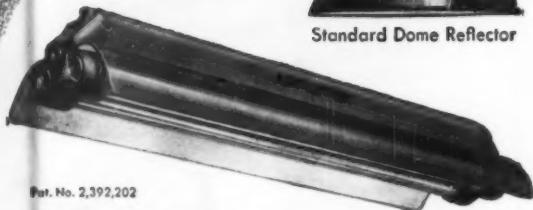
Products of more than a half century of experience, Appleton Lighting Fixtures are made to suit every industrial requirement—including hazardous locations—whether indoors or out. For the finest illuminating equipment or expert assistance on any lighting problem, contact Appleton—
Standard for Better Lighting.



Industrialite High Mounting Fixture
For High Bay Interiors



Standard Dome Reflector



Pat. No. 2,392,202

The EFU—First and Still Finest
Fluorescent Explosion-Proof Lighting Fixture

Available with two 40 Watt, 48" Lamps
or two 100 Watt, 60" Lamps.



Type EVX Vented
Explosion-Proof Fixture

Available for 60, 100, 150, 200,
300 and 500 Watt Lamps.

Standlite—for Filling
Stations, Parking Areas



SOLD THROUGH ELECTRICAL WHOLESALERS

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1704 WELLINGTON AVENUE • CHICAGO 13, ILLINOIS

Branch Offices: NEW YORK, 50 Church St. • DETROIT, 3049 E. Grand Blvd. • CLEVELAND, 1836 Euclid Avenue • SAN FRANCISCO, 655 Mission St.
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MINNEAPOLIS, 305 Fifth St. S. • PITTSBURGH, 414 Bessemer Bldg. • BALTIMORE, 100 E. Pleasant St. • BOSTON, 10 High Street • DENVER, 1921 Blake Street
PHILADELPHIA, 1017 Cherry Street • CINCINNATI, 626 Broadway • HOUSTON, 738 M. & M. Bldg. • HAVANA, Cuba, Malecon No. 9.
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APPLETON

CONDUIT FITTINGS • LIGHTING EQUIPMENT • OUTLET AND SWITCH BOXES • EXPLOSION-PROOF FITTINGS • REELITES

ELECTRICAL CONSTRUCTION AND MAINTENANCE

With which is combined Electrical Contracting, The Electragist and Electrical Record, established 1881

Published for electrical contractors, industrial electricians, engineers, consultants, inspectors and motor shops. Covering engineering, installation, repair, maintenance and management, in the field of electrical construction and maintenance.

49th Year - OCTOBER, • 1950

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Macy's

San Francisco



gets extreme flexibility

to handle load changes and future load growth

low installation cost

everything was shipped complete—as a unit—and easily installed

safety to personnel

no exposed circuits; metal encloses all current-carrying parts

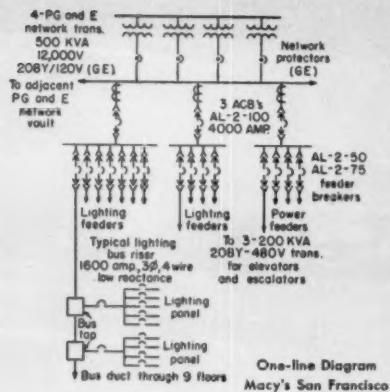
plenty of "IC"...with

100,000 amperes interrupting capacity, adequate to handle all short circuits

GENERAL ELECTRIC

HERE'S WHY . . . "In the department store business we cannot take any chances with power outages or potential fire hazards. We must also plan for expansion. That's why we wanted our power distribution system to be safe, to have adequate feeder and branch-circuit capacity, plus flexibility. General Electric switchgear gave us all these requirements."

E. L. MOLLOY, VICE PRESIDENT
MACY'S, SAN FRANCISCO

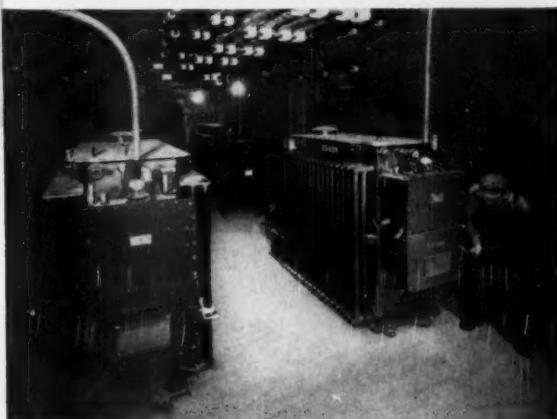


This, the largest switchgear installation to date in any San Francisco commercial building, adequately handles the power requirements that average four watts per square foot (nearly 500,000 square feet). Flexibility of the feeder system permits load changes without increasing the load on the switchgear. The 4000-ampere breakers have induction relay tripping.

Macy's installation is a complete General Electric project—switchgear, three 200-kva transformers for elevators and escalators, power and lighting panels, motors, and control for ventilating and boiler-room auxiliaries. One source of responsibility plus the very best in co-ordinated planning, engineering, manufacturing, and service facilities to give maximum savings and efficiency to the customer. William D. Day, San Francisco, architect; Clyde E. Bentley, San Francisco, consulting engineer.



G-E metal-enclosed switchgear handles the incoming 120/208-volt power. The equipment is divided into three sections, two for lighting, one for power. Breakers (cascaded) are of the drawout type for ease of inspection and maintenance.



Four G-E network units, rated 500 kva, 12,000-120/208 volts in a Pacific Gas and Electric Company vault serve the building. Macy's 2500-kva load represents one of the largest loads added to PG&E's downtown network in recent years.

low-voltage SWITCHGEAR

Modern industrial power distribution systems using G-E switchgear are applicable to any industrial plant or commercial building where you want proper voltage for top performance of equipment, an extremely flexible setup to take care of expanding or changing loads, adequate short circuit protection, safety to personnel, and low installation and maintenance costs.

Be sure to see the "More Power to America" full-color sound slidefilm "Modern Industrial Power Distribution." Ask your G-E sales representative to arrange a showing for your organization.

Investigate today the many advantages of using General Electric switchgear in your plant for efficient, flexible power distribution. Contact your G-E sales representative for further information—and write for the helpful bulletins listed below. Apparatus Department, General Electric Company, Schenectady 5, N. Y.

GEA-4966 Low-voltage Switchgear

GEA-3642 Air Circuit Breakers

GEA-2017 Network Protectors

GEA-3083 Metal-clad Switchgear

GEA-3592 Load-center Substations

GEA-3758 Load-center Distribution

GENERAL ELECTRIC



Welcome Mat for Air Visitors to Richmond—

HERE'S an airport reception center that truly says — Welcome. It's smartly designed — planned throughout to please the traveler. Extremely well lighted, too, with a variety of sturdy, easy-to-install fixtures by Litecontrol. To give a directional feeling — help guide the flow of traffic — corridors are lighted with fluorescent units with built-in insert and corner lens boxes. Square incandescent lens boxes are mounted over the counters and desks; round lens boxes with wide-angle lens give the general lighting required in the high-ceiling waiting room. For more information on these and other Litecontrol fixtures, write today.

Richard E. Byrd Flying Field

Administration Building, Richmond, Virginia.

Architect: Marcellus Wright & Son — Richmond, Virginia.

Mechanical Engineer: James Posey & Associates — Baltimore, Maryland.
Fixtures: No. 3224 and 3234 — 2 and 3 lamp recessed fluorescent lens* fixtures with No. 3200-22 recessed insert and corner lens* boxes. No. BF-M15 recessed lens* boxes. No. 12F-V30RW recessed round lens* boxes. No. 5F recessed Exit Signs.

Intensities: Waiting Room and Lobbies, 15-20 footcandles in service.

Offices (not shown) 35-50 footcandles in service.

*Equipped with CONTROLENS — © HOLOPHANE CO., INC.



LITECONTROL *Fixtures*

LITECONTROL CORPORATION

96 PLEASANT STREET, WATERTOWN 72, MASSACHUSETTS

DESIGNERS, ENGINEERS AND MANUFACTURERS OF FLUORESCENT LIGHTING EQUIPMENT DISTRIBUTED ONLY THROUGH ACCREDITED WHOLESALERS

Make Electrical Checks in a Hurry Without Interrupting Service!



HOOK-ON VOLT-AMMETER Type AK-1

Ratings:

Read 0-3/6/15/60/150/600 amperes

0-150/600 volts, a-c

\$74.75 *

Leather Case \$10.00 *

6-Foot Hot Stick \$10.00 *

HOOK-ON WATTMETER Type AK-2

Ratings:

Read 0-3/6/20/60/200/300 kw

0-15/600 amperes

0-100/600 volts, a-c

\$84.75 *

Leather Case \$10.00 *



Spot trouble before it starts. To measure current, simply hook the jaws around a conductor—no cutting lines, no breaking circuits. For voltage readings, you click selector switch to desired scale and connect voltage leads to circuit. One instrument measures both!

Avoid circuit breakdowns by checking current in fuses, breakers, switches and panels. Costly shutdowns of motors, transformers and other equipment can be prevented by periodic checks. Use on a-c only.

*Manufacturer's suggested retail prices.

**MAIL YOUR ORDER
TODAY**



**GENERAL
ELECTRIC**

Section A 602-185
General Electric Co.
Schenectady 5, New York

Date _____

PLEASE SHIP ME THE FOLLOWING:

Total Price

Number	AK-1 Volt-ammeter (No. 99X33)....	_____
	with leads	_____
	AK-1 Leather Case (No. 99X38).....	_____
	6-foot Hot Stick (No. 99X68).....	_____
	AK-2 Wattmeter (No. 378X88).....	_____
	with leads	_____
	AK-2 Leather Case (No. 8941377)....	_____

I understand that I'll be billed when these are delivered.

Signed _____

Company _____

Address _____ Street _____ City _____ State _____

You can't buy Better Fittings or ones that cost less to use



Quicker to use and neater in appearance, Briegel All-Steel Indenter Fittings not only make stronger connections but also make each job more profitable to the contractor and satisfactory to his customers.

Two Easy Squeezes and they're set to stay. It is only natural that the Briegel All-Steel Indenter Fittings are the most widely used E.M.T. connectors and couplings. Contractors the world over recognize their cost cutting qualities and the fact that they make each wiring job neater, stronger and better.



All B-M Fittings Carry the
Underwriters Seal of Approval



BRIEGEL METHOD
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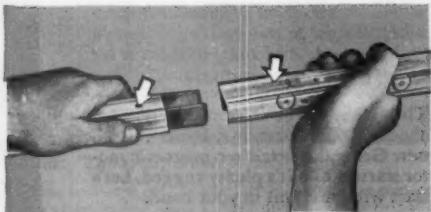
GALVA, • ILLINOIS

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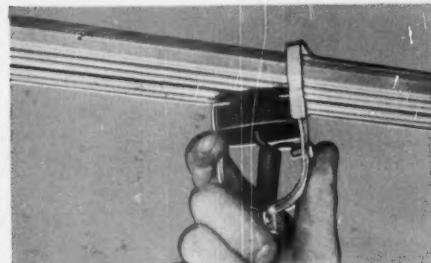
The M. B. Austin Co., Northbrook, Ill.; Clayton Mark & Co., Evanston, Ill.; Clifton Conduit Co., Jersey City, N. J.; General Electric Co., Bridgeport, Conn.; The Steelduct Co., Youngstown, Ohio; Enamelled Metals, Pittsburgh, Penn.; Kondu Mfg. Co., Ltd., Preston, Ont.

How to move or add lights anywhere, anytime without costly rewiring

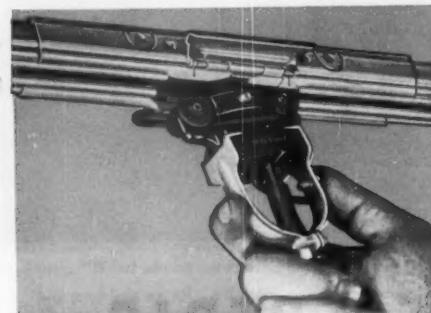
BullDog Universal Trol-E-Duct provides continuous outlet, completely flexible lighting



Duct sections are joined without tools, nuts or screws. Prefabricated and standardized in lengths from one to ten feet, they can be dismantled and reinstalled anytime, anywhere without scrapping a single part.



To tap off power at any point along the slot, simply insert twist-out plug and give it a 90° turn. Plugs are grounded on steel casing before contacts touch bus bars; narrow-access slot protects operator.



Trolley-type outlets are used where mobility is a prime requisite—such as for small portable tools or for drop-cord lighting in stock bins and inspection areas.



Safe, simple, quick! Tap off power from totally enclosed bus bars at any point along the continuously slotted duct with handy trolleys or twist-out plugs. Universal Trol-E-Duct both supports and supplies current to these fluorescent lighting fixtures.

LIGHTING changes come high with old-fashioned fixed outlet systems! Lick this problem once and for all with modern, economical BullDog Universal Trol-E-Duct.

Every inch of this sensational 50-A. duct system is a tap-off! To move or add lights or small power tools, simply pick the right spot and insert handy twist-out plug or trolley. And it can be dismantled and moved anywhere, anytime without scrapping a single part.

Learn more about this modern, efficient system today from your nearby BullDog Field Engineer. He will be glad to show you a typical installation near your plant. Or write BullDog direct for descriptive literature.

BULLDOG ELECTRIC PRODUCTS COMPANY
DETROIT 32, MICHIGAN — FIELD OFFICES IN ALL PRINCIPAL CITIES
IN CANADA: BULLDOG ELECTRIC PRODUCTS OF CANADA, LTD., TORONTO



BULLDOG

HEADQUARTERS FOR ELECTRICAL DISTRIBUTION

New!



**MOTOR
STARTERS**



5 reasons why

R. S. PYNE, THE VAN NORMAN COMPANY,

Mr. Pyne: "The one thing my machine-tool customers want in a starter is durability. It's got to stay on the job year in and year out. And that, without a lot of expensive maintenance, too."

Then they want that starter you're about to take apart, Mr. Pyne. It's the new General Electric a-c magnetic motor starter—and it's plenty rugged. Let's start with that coil in your hand.



GENERAL  **ELECTRIC**

730-11

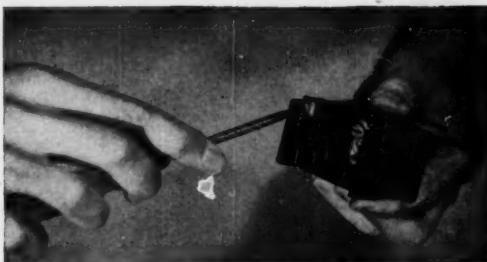
G-E starters last longer!

PROVES IT FOR HIMSELF WITH THE SCREWDRIVER TEST



Mr. Pyne: "Looks different. What's it got?"

1 That coil—we call it the "strong box" magnet coil—lasts two to five times longer than a conventional coil. Suppose the electrician's screwdriver slips and hits the coil. The windings can't be damaged because they're firmly locked in a block of molded plastic.



Mr. Pyne: "Will these terminals work loose?"

2 Not a chance! They're permanently anchored in the coil enclosure so they can't loosen, even after years of operation. You'll notice they're on the front of the coil, too. That makes for easier servicing.



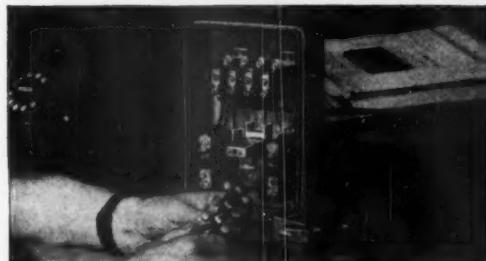
Mr. Pyne: "This magnet moves smoothly enough."

3 Yes—and you can be sure it will do just that even after it's been in service for years. That's because the plastic coil block is made with a permanent "molded in" lubricant. No metal-to-metal friction, no bearings to wear!



Mr. Pyne: "Contacts that burn easily seem to be a major headache. How about these?"

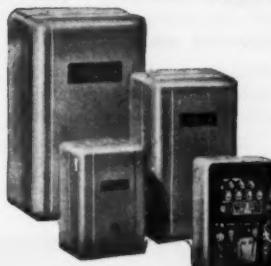
4 Under average conditions you can count on these contact tips to stand up even on the toughest "start-stop" service. They're made of fine silver and there's little chance of their welding together thanks to a high initial tip pressure. And the arc hood keeps each tip protected in its own chamber.



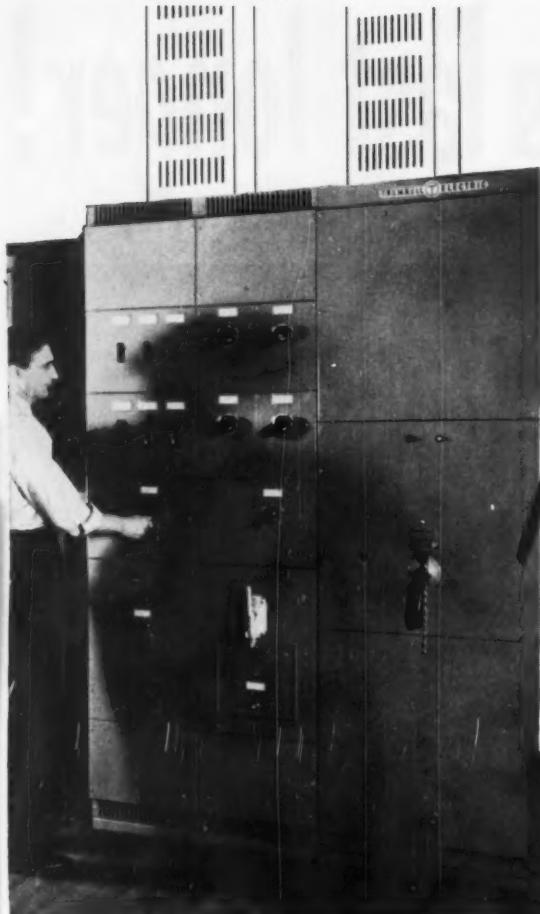
Mr. Pyne: "What about corrosion?"

5 No problem at all! All steel parts are zinc plated. The arc chutes are impregnated with a special wax to resist moisture absorption. Finally, the case is coated with a special corrosion-resisting material and painted an attractive gray.

WHY DON'T YOU BUY ONE AND COMPARE



Make the screwdriver test yourself—and see why the new G-E magnetic motor starter lasts longer than any other you can buy. Your G-E representative or distributor salesman can supply you with this new starter from stock in NEMA sizes 0, 1, 2, and 3 for a-c motors up to 50 hp. For a complete description, write for the "sell all" bulletin, GEA-5153, Section 730-11, Apparatus Dep't., General Electric Company, Schenectady 5, N.Y.



Announcing
Centr-A-Power

...custom-built... pre-engineered



**New Features Save Floor Space,
Speed Up Wiring, Facilitate Operation**

LESS FLOOR SPACE NEEDED

Compact trough design allows more troughs to be used in a given area of floor space.

LOTS OF ROOM FOR WIRING

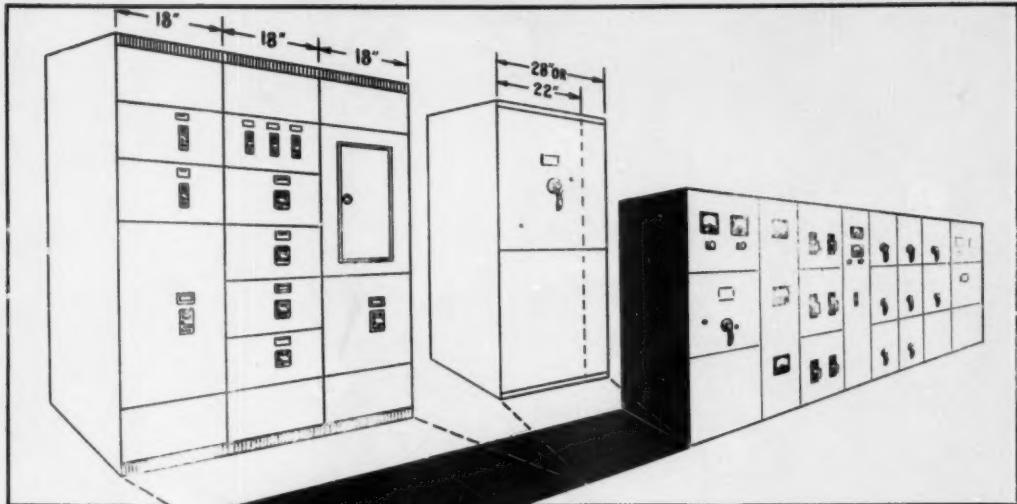
Generous (4 x 8 in.) wiring gutter makes wiring easier—can be accomplished with units in the trough—and allows use of over-size cable on long runs, keeping voltage drop low.

ACCESSIBLE FROM FRONT

CENTR-A-POWER Switchboards are completely accessible from the front, permitting aisle, back-to-back, "L" and "U" installations, further saving floor space.



TRUMBULL'S TRAINLOAD OF NEW PRODUCTS



Switchboards

...at money-saving prices

To save you money on installation time and maintenance costs, Trumbull has designed a new type of switchboard for complete low voltage (600 V and under) switching requirements. Because of pre-engineering and standardization, you can now have the highest quality construction at the lowest possible cost. Here are some of the features:

Pre-fabricated, rigid steel troughs can be placed in any arrangement to provide a completely dead-front, totally-enclosed switchboard. Wiring gutter design is such that load wiring is isolated from incoming load bus. Compact switch or breaker units, called CENTR-A-PLUGS, are easily mounted or removed. A quick-clip attachment saves time in installation, inspection and maintenance. Self-aligning latches replace bolts and nuts. Positive connection to bus bars is assured by use of spring-loaded, reinforced stabs. Each CENTR-A-POWER unit self-contained and electrically isolated from adjacent units.

How CENTR-A-POWER Fits in with Your Present Rigid Type Switchboard Equipment

CENTR-A-POWER is made from three standard troughs, all 90 in. high. At left is unit type CENTR-A-POWER with 18 in. trough; it handles fusible switches through 200 amp. and circuit breakers through 600 amp. Two standard section troughs are indicated in the center. Type A is 22 in. wide, handles 400 and 600 amp. fusible switches. Type B is 28 in. wide, handles fusible switches through 1200 amp. and circuit breakers through 1600 amp.

Unit-Type Troughs (18 in.) are furnished assembled or unassembled. Large standard sections are furnished assembled only.

ASK ABOUT TRUMBULL CENTR-A-POWER CONTROL CENTERS

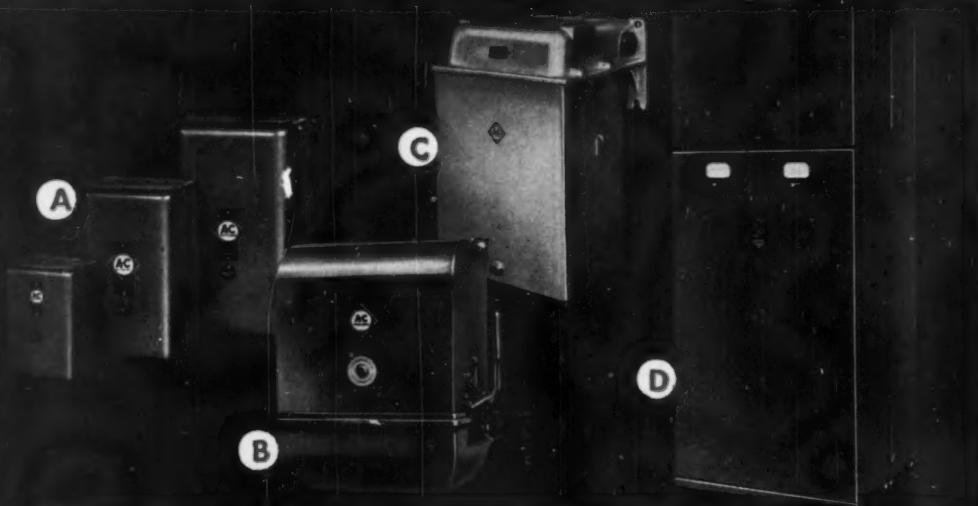
*which are of similar construction and line up mechanically and electrically with
CENTR-A-POWER Switchboards.*

New Free Bulletin—Address The Trumbull Electric Manufacturing Company, Plainville, Conn. Ask for Bulletin TEB-3.

TRUMBULL ELECTRIC



TRUMBULL'S TRAINLOAD OF NEW PRODUCTS



For Squirrel-Cage Motors:

A. FULL VOLTAGE STARTERS in a variety of sizes and enclosures. Send for bulletin 14B7132.

B. REDUCED VOLTAGE STARTERS: Manual and Magnetic Autotransformer Reduced Voltage Starters, and Magnetic Primary Resistor Starters.

C. For FULL VOLTAGE STARTING OF 2300-2500 volt motors of less than 350 hp., Type 371 Starters can be used in dusty, corrosive, hazardous locations. Bulletin 14B7274.

For Wound Rotor Motors:

A wide variety of starters; Manual Primary and Secondary, Magnetic Primary and Secondary, Magnetic Primary with

Manual Secondary, and Drum Type Reversing Primary and Secondary.

D. HIGH INTERRUPTING CAPACITY STARTERS for *Squirrel-Cage*, *Wound Rotor* and *Synchronous Motors*. These starters have current limiting features. They can be connected directly to circuits requiring up to 150,000 KVA at 4160 to 5000 volts without back-up circuit breaker. Bulletin 14B6410A.

THERE IS AN ALLIS-CHALMERS STARTER for Every Motor Need

YOU GET WIDE SELECTION of starter type, size and enclosure for each type motor.

YOU GET DEPENDABLE OPERATION! Allis-Chalmers starters are generously designed, durably built.

EASE OF MAINTENANCE results from built-in accessibility of renewable parts.

MANY PROTECTIVE FEATURES! Overload, undervoltage, interlocking and other devices mean greater safety for equipment and personnel.

PLUS BROAD APPLICATION EXPERI-

Texrope and Vari-Pitch are Allis-Chalmers trademarks.

ENCE means the right starter for your job! Allis-Chalmers engineering experience covers every major industry.

REMEMBER, ALLIS-CHALMERS OFFERS BOTH Full and Reduced Voltage Starters for *squirrel cage* and *synchronous motors* as well as control for *wound rotor motors*. Depend on this wide range of starters, backed by industry-wide application engineering experience, for the answer to your control needs! Call your nearby A-C sales representative, or write direct for the bulletins indicated above. A-3140

ALLIS-CHALMERS, 930A SO. 70 ST.
MILWAUKEE, WIS.

Sold ...

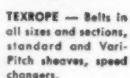
Applied ...

Serviced ...

by Allis-Chalmers Authorized Dealers,
Certified Service Shops and Sales Offices
throughout the country.



MOTORS — $\frac{1}{2}$ to
25,000 hp and up.
All types.



TEXROPE — Belts in
all sizes and sections,
standard and Vari-
Pitch sheaves, speed
changers.



PUMPS — Integral
motors and coupled
types. Sizes and rat-
ings to 2500 GPM.

ALLIS-CHALMERS



Troubled with Water and Chemicals?

LOOK INTO
Insulation made of

- YOUR CHOICE of industrial wire and cable insulated for maximum protection against water and chemicals... *should be based on facts!*

Wire and cable insulated with VINYLITE Brand Plastics have been tested in the laboratory and in extensive commercial service in many chemical and process plants for over fifteen years. A great deal has been learned by Bakelite engineers cooperating with wire manufacturers, on how to modify VINYLITE Plastics and Resins to provide ever better insulation to meet specific applications.

As a result, numerous formulations of VINYLITE Resins are now available to provide, where called for, better dielectric properties, increased heat re-

Vinylite
BRAND
PLASTICS 
BAKELITE DIVISION 

sistance, lowered cold temperature flexibility, and stronger resistance to chemical attack by acids, alkalies, oils, water, etc.

If you need wire and cable insulated to withstand unusual conditions, by all means come to Bakelite. We are prepared to analyze your insulation problems on the strength of our long experience, and to furnish you with a list of representative suppliers of wire and cable insulated with the VINYLITE Resins that can meet your specific requirements. Write Department IE-41.

BAKELITE DIVISION, *Union Carbide and Carbon Corporation*, 30 East 42nd Street, New York 17, N.Y.

**GOOD CONNECTIONS
ARE
IMPORTANT...**

**especially in
BUSDUCT**

Distribution Systems

PLUGIN FA BUSDUCT

Is available in standard 10 foot sections . . . also special lengths . . . 250 to 1000 Amps., 600 volts or less; 2, 3 and 4 conductors, with 30, 60, 100 and 200 Amp. FA Plugin devices.

Good, dependable connections are a big feature of PLUGIN FA BUSDUCT. This results from the fact that all joint connection contact surfaces are ground smooth, and then heavily electro silver-plated by immersion.

Heavy brass jam bolts—two for 2" wide copper and less . . . four for widths up to and including 4"—with heavy phosphor bronze compression washers, are used to fasten bus bars. Bolt holes are elongated to allow for expansion and contraction.

These two FA features of joint connections reduce to a minimum voltage drop and heating, which impair efficiency.

If you are interested in more efficient, economical and flexible power distribution, or if you want to expand your present production facilities, let your nearest FA Representative (he's listed in Sweet's) tell you how to do it quickly and easily with PLUGIN FA BUSDUCT or ask for Bulletin 701.



Frank Adam Electric Co.

ST. LOUIS 13, MISSOURI

Makers of **BUSDUCT • PANELBOARDS • SWITCHBOARDS • SERVICE EQUIPMENT • SAFETY SWITCHES • LOAD CENTERS • QUIKHETER**

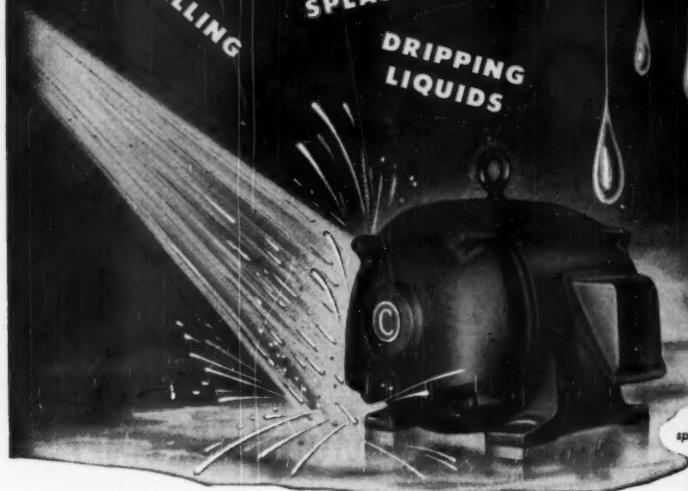
For Dependable **PROTECTION**

Against Hazards of

FALLING

SPLASHING

DРИPPING
LIQUIDS



Direct current
splash proof motor



Wound rotor splash proof
Polyphase motor



Repulsion start induction brush
lifting single phase splash
proof motor.

Use *Century* **Splash Proof Motors**

Whether installed indoors or outdoors, Century Splash Proof motors eliminate production losses caused by liquids entering the vital parts of the motor. The unique design of the Century Splash Proof frame prohibits water from entering, even during applied with the full force of a hose during a plant wash-down.

For many years Century Splash Proof motors have proved their dependability in chemical processing plants, dye houses, food and dairy plants—on outdoor cooling

towers, oil well pumping units, as well as many others.

Wherever splashing liquids create a hazard, specify the correct Century motor housed in a splash proof frame.

For popular applications throughout industry, Century builds electric motors in a wide range of types and kinds—in sizes from 1/6 to 400 horsepower.

Specify Century motors for all your electric power requirements.

CENTURY ELECTRIC CO. 1806 Pine St., St. Louis 3, Mo.

Offices and Stock Points in Principal Cities

ALTERNATING CURRENT MOTORS

POLYPHASE

Squirrel Cage Induction—1/8 to 400 H.P.
Wound Rotor Motors—1 to 400 H.P.
Synchronous Motors—20 to 150 H.P.

SINGLE PHASE

Split Phase Induction—1/6, 1/4, 1/3 H.P.
Capacitor—1/6 to 20 H.P.

Repulsion Start, Brush Lifting, Induction—
1/2 to 20 H.P.

DIRECT CURRENT MOTORS

1/6 to 300 H.P.

GENERATORS

AC, 63 to 250 KVA
DC, 75 to 200 KW

GEAR MOTORS

1/8 to 1-1/2 H.P.

MOTOR GENERATOR SETS

AC to DC, AC to AC
DC to DC, DC to AC

Open Protected, Splash Proof, Totally Enclosed Fan Cooled, Explosion Proof.

Ball Bearing motors are factory lubricated for several years' normal service. Bearing housing construction permits easy re-lubrication when unusual service demands it.



671



PREST-O-LITE Torches provide a high-temperature flame instantly.

INTENSE HEAT...

*Prest-O-Lite GAS

Trade-Mark

PREST-O-LITE Torches burn PREST-O-LITE Acetylene from small tanks in two handy sizes: B tank (40 cu. ft.), MC tank (10 cu. ft.) Tanks and refills are readily available from thousands of Prest-O-Lite Gas Exchange Stations throughout the United States and Canada. Return your empty tank to any station, get a full one back, and pay only for the gas.



MC TANK B TANK

ready for instant use

A flame temperature as high as 2,800 degrees Fahrenheit—heat to spare for all of your soldering, heating, and light brazing—can be produced by any PREST-O-LITE Torch, using PREST-O-LITE Gas.* Yet complete control of this intense flame is always at your finger tips. A turn of a needle valve gives you the exact flame for the job.

Indoors or out, PREST-O-LITE Torches give a clean, full-heat flame the moment you open the valve and light the gas—no pumping, priming, or warmup is ever needed. They're light . . . easy to handle, even in hard-to-get-at places. And there's no waste of fuel between jobs.

Your jobber can show you how to do more jobs better, in less time, with PREST-O-LITE Torches. Ask him to demonstrate the many ways a PREST-O-LITE Torch can save you time and money.

If you don't know your jobber, write us for his name or further information about PREST-O-LITE equipment for soldering, heating, and brazing. The Linde Air Products Company, 30 East 42nd Street, New York 17, N. Y. In Canada: Dominion Oxygen Company, Limited, Toronto.

Order from your local Jobber

The term "Prest-O-Lite" is a trade-mark of The Linde Air Products Company, Unit of Union Carbide and Carbon Corporation.



The design of Penn-Union Multifit Connectors retains the full strength and rigidity of the silicon bronze bolt. The saddle which provides a wide surface to grip and protect the cable is permanently fastened to the U-bolt; one piece. *The strongest and most satisfactory fitting of this type.* High copper content alloy; silicon bronze Nuts and Lockwashers as well as Bolts. . . . ★ Each Multifit Connector takes a wide range of conductor sizes; only a small stock will provide for many needs. Made in a complete range for cable up to 2,000,000 cm.

The Penn-Union Line also includes numerous other types of Tees, Lugs, and Straight Connectors, as well as Service Connectors, Bus Supports, Grounding Clamps, Cable Taps, etc., etc. Experienced users have found that the Penn-Union mark on a fitting is the best guarantee of satisfactory performance.

Sold by Leading Wholesalers

PENN-UNION ELECTRIC CORPORATION Erie, Pa.

Canada: Dominion Cutout Co., Ltd., 250 Richmond St. West., Toronto, Ontario



THE *Complete* LINE OF CONDUCTOR FITTINGS

PENN-UNION

**READ WHAT
USERS SAY
ABOUT**

**G.E.'s New All-Purpose*
Insulating Varnish G-E 9574**

J. L. Hughes, owner of the J. L. Hughes Electric Company, Columbus, Ohio, says:

"We have found from test and practical experience that General Electric general-purpose varnish 9574 is tops for our work."



J. Lindborg, owner of AAA Electric Motor Service, Atlanta, Ga., says:

"Our experience has been that this varnish is as good as G.E. claims. It gives a good coat on every type of wire, bakes easily and dries to a tough coating that stands up perfectly in service."



Guy W. Probst, owner of Lockhaven Electric Repair Co., Lockhaven, Pa., says:

"I find that I only use about half as much 1201 Glyptal as a cover coat on 9574 as I had to use over the varnish I had been using, and I get higher gloss and better bonding."

These statements indicate the success of the new G-E 9574. If you are looking for an insulating varnish which bakes at low temperatures, penetrates deep coils easily, and requires no special thinner, investigate G-E 9574.

*G-E 9574 gives excellent results on all types of coils except extra-high-speed armatures. It is one of G.E.'s complete line of electrical insulating materials, including wedges, adhesives, cements, compounds, cords and twines, sleeving, wire enamels, mica, papers and fibers, permaflats, tapes, tubing, varnished cloths, and varnishes.

Here's A Bulletin You Should Have! If you haven't yet tried G-E 9574 get in touch with your local G-E Distributor, or write for our new bulletin to Section K3, Chemical Department, General Electric Company, Pittsfield, Massachusetts.

You, too, can put your confidence in

GENERAL ELECTRIC



MAKING A TOUGH CABLE

Tougher!

Stripping off
the lead sheath
after a Tirex Cable
has been
“Cured-In-Lead”



...That's what the "Cured-In-Lead" process is doing for every TIREX portable cable — adding extra wearability to their Selenium Neoprene Armor to assure long, trouble-free service under the most severe operating conditions.

HERE'S HOW IT'S DONE

Before jacket vulcanization the cable is run through a lead press which forms a lead "pipe" snugly around the jacket. During vulcanization this pipe firmly holds the cable, preventing any distortion of the jacket while it is still soft and pliable and assuring maximum density. When vulcanization is completed the lead is stripped off leaving an extra-tough jacket that needs no additional protection.

HERE'S WHAT IT DOES

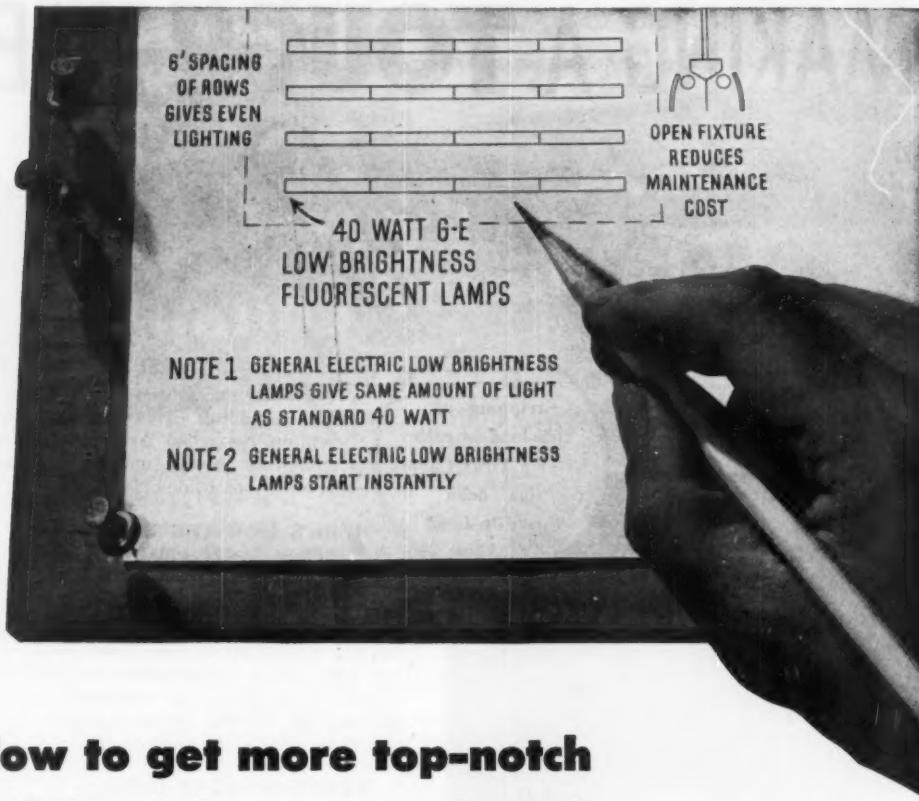
It produces a jacket that is unexcelled for effective resistance to abrasion and rough handling . . . provides it with a smooth outer surface which slides easily around obstructions without cutting or tearing . . . maintains uniform diameter, assuring easy and compact reeling or coiling . . . furnishes the means for positive identification of the size, type, number of conductors, and operating voltage of each cable as markings inside the lead pipe can be transferred to the jacket during vulcanization.

All TIREX Cables, and TIREX Cords too, are cured in lead. They are made in sizes and types to meet the requirements of all portable electric equipment. For a complete description of the "plus values" they provide, write us today for Folder 993.

SIMPLEX-TIREX

SIMPLEX WIRE & CABLE CO.

79 Sidney Street
Cambridge 39, Mass.



How to get more top-notch lighting jobs on your board

Here's a special lamp for special jobs—the General Electric *low-brightness* lamp. It offers the kind of advantages that are bound to help bring in more orders for top-quality lighting jobs.

REDUCED GLARE

These 40-watt T-17 fluorescent lamps give as much light as standard 40-watt T-12 G-E lamps, but deliver it from a much bigger tube. With low-brightness lamps reflected glare is reduced.

EASY MAINTENANCE

Low-brightness lamps are frequently used in open troffers and fixtures without cross louvers. That makes them easy

to get at for replacing and cleaning. For example, at the Flossmore school in Chicago, janitors clean the lamps with a vacuum cleaner attachment as they walk down each row.

INSTANT START

General Electric low-brightness lamps start instantly—and customers have no starters to maintain.

You'll find low-brightness lamps a good buy for schools, offices, and quality shops that want fine lighting. For more data, call your G-E lamp supplier or your nearest General Electric lamp district office.



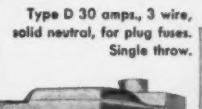
GENERAL ELECTRIC

The Cutler-Hammer Type D Line

Broad Range of Sizes Types and Enclosures



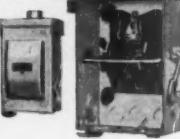
Type D 30 amps.,
2 poles fusible, for plug
fuses. Single throw.



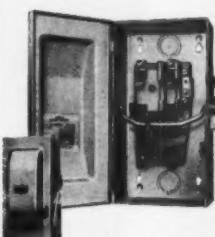
Type D 30 amps.,
3 wire, solid neutral,
for plug fuses.
Single throw.



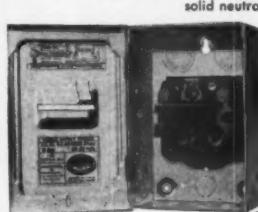
Rainlight Type D 30 amps.,
3 wire, solid neutral,
for plug fuses.



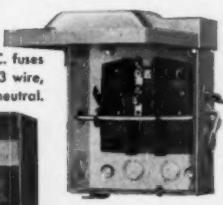
For N.E.C. fuses...
Type D 30 amps., 3 poles,
fusible.



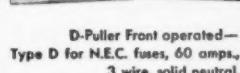
For N.E.C. fuses...
Type D 60 amps., 3 wire,
solid neutral, fusible.



Rainlight for N.E.C. fuses
... Type D 30 amps., 3 wire,
solid neutral.



D-Puller Front operated—
Type D for plug fuses,
30 amps., 2 poles.



D-Puller Front operated—
Type D for N.E.C. fuses, 60 amps.,
3 wire, solid neutral.



**cost-cutting
SAFETY SWITCHES
to answer many problems**

The Cutler-Hammer Type D line of General Duty Safety Switches is popular with electrical contractors and wholesalers because it has so many uses in so many places. These inexpensive quality products have ready acceptance for use with workshop tools, oil burners and stokers, laundry appliances, air conditioning and refrigerating units, feed grinders, compressors . . . in home, shop, farm, commercial buildings, and for service entrance too. Job requirements for heavy duty lighting circuits are amply met by the larger capacity Cutler-Hammer Type D Switches.

Quality Products at No Extra Price

These General Purpose Switches are built, as all Cutler-Hammer Products are built, not down to a price but up to a standard of excellence that is known wherever electrical products are used. Some of the construction details that tell you why the Cutler-Hammer reputation is well-deserved are given below.

Features that Mean Better Performance on the Job

"Easy-tight" wire holes on terminals provide quick, solderless connections. Inorganic base will not carbonize or disintegrate, dissipates heat developed by fuse wattage, results in cooler operation. Double faced contacts with wiping, self-cleaning action insure cool, continued performance. Single break; no needless overloading of switch mechanism. Sturdy shock resistant cases. Provision for padlocking in "off" position, ample concentric knock-outs, ample wiring space. These are some of the many quality features of the C-H Type D Line.

Dependability that Has Established C-H as Standard

Whenever and wherever electrical men want reliability, they insist on Cutler-Hammer Safety Switches, carried in stock—by distributors everywhere. CUTLER-HAMMER, Inc., 1306 St. Paul Ave., Milwaukee 1, Wisconsin.



It's easier to work the Threadless way



With threadless ELECTRUNITE E.M.T., you merely cut the tubing to desired length, slip on the simple compression coupling and tighten with wrench and pliers . . . no need for thread-cutting or turning long lengths of conduit into the fitting.

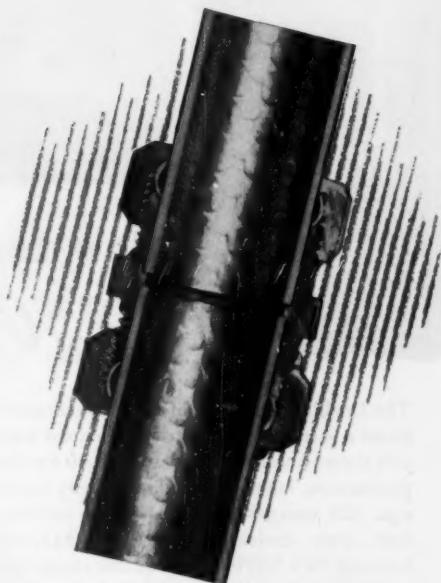
with ELECTRUNITE E.M.T.

Any way you look at it, wiring jobs go in easier when you use ELECTRUNITE E.M.T.—the *modern* lightweight rigid steel wiring raceway.

With ELECTRUNITE E.M.T., tight-gripping compression fittings eliminate tedious thread-cutting . . . bends are made quickly and easily with predetermined accuracy . . . wire pulling, by actual test, is as much as 30% easier than with ordinary types of conduit.

Yes, by any yardstick, ELECTRUNITE E.M.T. is easier to handle and easier to install. Yet, it provides the safe, dependable wiring protection that you get *only* in rigid steel raceways. For complete information about all of the job-proved advantages of ELECTRUNITE E.M.T., see your nearest ELECTRUNITE Distributor or write today to:

REPUBLIC STEEL CORPORATION
STEEL AND TUBES DIVISION • CLEVELAND 8, OHIO
Export Department: Chrysler Building, New York 17, N.Y.



Cross-section cutaway showing two lengths of ELECTRUNITE E.M.T. joined by a water-tight compression fitting. Note the knurled inside surface that cuts down friction drag when wires are pulled through an ELECTRUNITE raceway.



Republic
ELECTRUNITE E.M.T.

LIGHTWEIGHT THREADLESS RIGID STEEL RACEWAY

YOU CAN BE SURE.. IF IT'S

Westinghouse



How Lee Lime Co. bagged a \$12,500 ANNUAL SAVING!

The Lee Lime Company of Lee, Massachusetts, faced a serious outage problem. Actual analysis showed each outage cost \$100.00 for lost production, labor cost and machinery breakage. 125 outages per year, due to ordinary fuse safety devices, added up to \$12,500. Looking for a way to eliminate this staggering loss, they installed two AB-I Breakers. Result? Complete elimination of 125 outages, and a \$12,500 saving was in the bag.

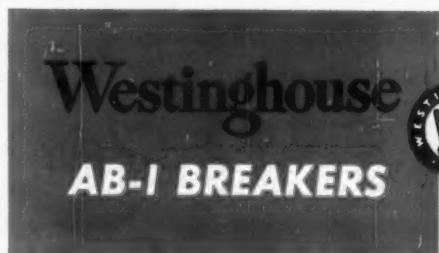
This dollar-saving experience led the Lee Lime Company to install other AB-I Breakers. The group pictured above eliminated one outage per day for an estimated annual saving of \$2,600.00.

Savings like these are worth getting. See for yourself the many superior features AB-I Breakers have over ordinary protec-

tive devices. AB-I Breakers permit harmless overloads, but trip instantly when a dangerous overload occurs. And remember, there are no fuses to replace, no delays in restoring service. The workman can restore service immediately without danger or exposure to live parts.

Get all the money-saving facts. Contact your nearby Westinghouse representative or write for Bulletin DB-30-230, Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania.

J-30029





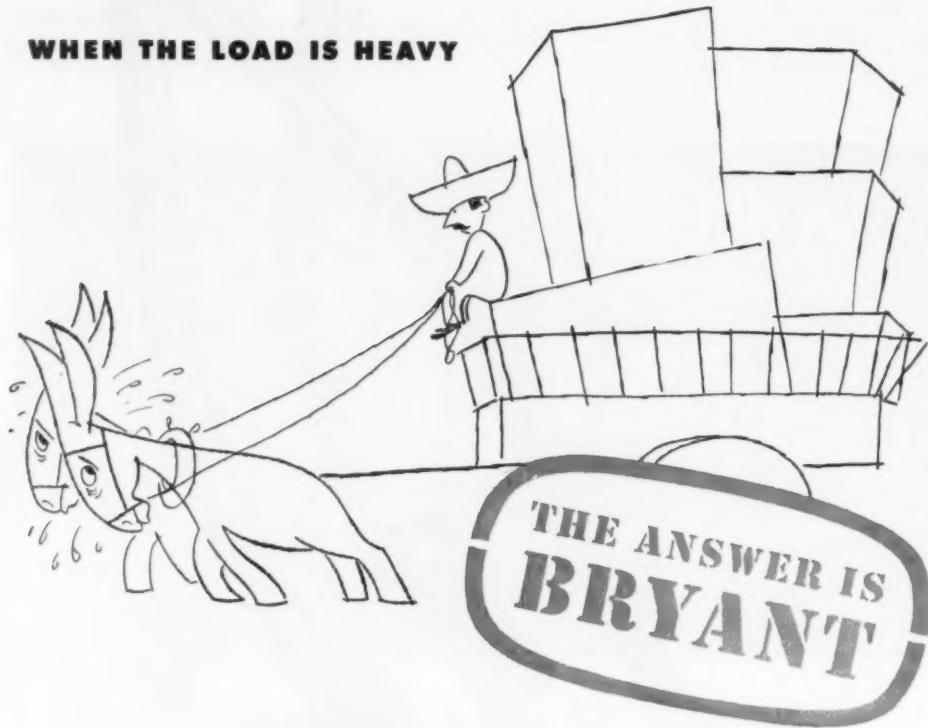
all's well that ends with **BURNDY**



Here are just a few of many Burndy terminals—each one designed to do its specific job...faster, neater, better!—each reflecting the famous Burndy "engineered" quality—each one proof that, for best results in the end, it pays to Connect with BURNDY

BURNDY, New York 54, N.Y. Burndy Canada Ltd., Toronto 11, Ontario. Western Branch: Vernon 11, California

WHEN THE LOAD IS HEAVY



**THE ANSWER IS
BRYANT**

**WITH BRYANT 5861 LINE
OF 20 AMPERE
FLUSH SWITCHES**

These heavy duty switches are built for service in commercial, institutional and industrial installations where more severe loads are encountered.

Shallow cup, $1\frac{1}{8}$ " deep, permits installation in conventional switch boxes.

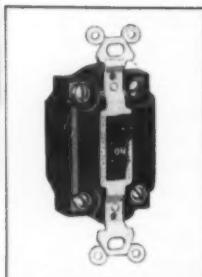
The mechanism is equipped with snuffers and is entirely enclosed in a rugged bakelite housing.

The washer type plaster ear yoke is insulated from the mechanism. Large, well-recessed binding screws permit easy wiring.

Available in single pole, double pole and three-way types with brown and ivory handles. Lock and momentary contact features can be furnished.

Meets all specifications.

Listed as standard by Underwriters' Laboratories, Inc.



J 99835



THE BRYANT ELECTRIC COMPANY

Bridgeport 2, Connecticut

CHICAGO • LOS ANGELES

SPECIFY BRYANT DEVICES FROM YOUR ELECTRICAL WHOLESALER



Get All-Around Motor Protection with **SAFETY-CIRCLE**

THAT SOLID CAST IRON FRAME protects *Safety-Circle* working parts against physical damage from every angle. The completely enclosed bottom provides extra protection and extra strength. End brackets are drip-proof at no premium.

Because the frame is cast iron, it is resistant to rust and corrosion. It withstands physical abuse and will not distort.

Protected Inside, Too

Safety-Circle protects against internal breakdown with multiple-dipped and baked

stator and die-cast aluminum rotor. Ball bearings are factory-lubricated and need no attention for years. Wide open internal construction and large fans keep temperatures well within rated limits.

Don't be satisfied with a motor that gives you less than full protection. Insist on the extra protection of *Safety-Circle*.

For complete details on *Safety-Circle* advantages, see your A-C Authorized Dealer, Sales Office, or write for Bulletin 51B6210B. Sizes from 1 to 20 hp, 326 frames and smaller.

A-3143

Safety-Circle, Texrope and Vari-Pitch are Allis-Chalmers trademarks.

ALLIS-CHALMERS, 930A SO. 70 ST.
MILWAUKEE, WIS.

**Sold . . .
Applied . . .
Serviced . . .**

by Allis-Chalmers Authorized Dealers,
Certified Service Shops and Sales Offices
throughout the country.



CONTROL — Manual, magnetic and combination starters; push button stations and components for complete control systems.



TEXROPE — Belts in all sizes and sections, standard and Vari-Pitch sheaves, speed changers.



PUMPS — Integral motor and coupled types from $\frac{1}{6}$ in. to 72 in. discharge and up.

ALLIS-CHALMERS

BIDDLE

Instrument News

- ELECTRICAL TESTING INSTRUMENTS
- SPEED MEASURING INSTRUMENTS
- LABORATORY & SCIENTIFIC EQUIPMENT

NUMBER 3 OF A SERIES

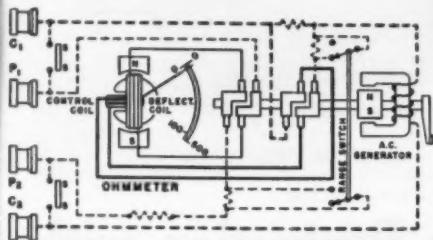
JAMES G. BIDDLE CO., 1316 ARCH ST., PHILADELPHIA 7, PA.

NEW CVM TYPE MEGGER® GROUND TESTER

... Provides Simple, Single Test Method for Measuring Resistance of Earth to Ground Connections

This modern design, strong, compact ground tester weighs only 6 pounds, measures $7\frac{1}{2}'' \times 5'' \times 5\frac{1}{4}''$. An ideal, easy-to-use field instrument for determining if the resistance to earth of man-made grounds is sufficiently low to minimize dangers due to lightning.

It is a completely self-contained test set with its own generator for supplying test current—no dependence on batteries or other current supply.



For complete details and prices on this New instrument, write for Bulletin 25-80-ECM.



ELECTRICAL MAINTENANCE APPLICATIONS of LOW RESISTANCE MEASUREMENTS

Cable and Conductor Joints
Oil Circuit Breaker Assemblies
Rotating Equipment
Transformers and Coils

...QUICKLY CHECKED with DUCTER®

LOW RESISTANCE OHMMETER

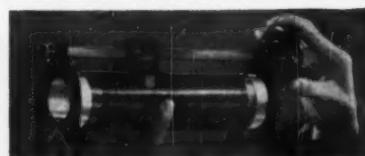
High-resistance conductor joints and connections cause objectionable voltage drops, loss of power, and damage from localized heating. Quick and reliable measurements of joint and contact resistance during manufacture, at installation, and periodically while in service are therefore good insurance against malfunctioning and trouble.

Several of the joints and contacts throughout oil circuit breakers, from top-terminal of the bushings to associated bushings, may give serious trouble when unnecessary heating develops.

In rotating equipment shorted commutator bars, shorts in armature coils, and shorts between equalizers or cross connections, and also high resistance joints between commutator bars and risers, spell inefficient performance and trouble.

Proper winding resistances of transformers and of coils are as important as in any other electric circuit, with one exception — such windings have inductive characteristics, as well as d-c resistance.

Anyone familiar with these types of equipment can measure ohmic resistances down to a few millionths of an ohm with the DUCTER® Low Resistance Ohmmeter. Valuable information on this subject is contained in our Bulletin 24-25-ECM.



"JAGABI"® LUBRI-TACT POWER RHEOSTATS

Standard Types in

76 Different Ratings

For fine adjustment and control of electrical current—from "zero" to as high as 25 and 50 amperes. Engineers and laboratory workers find "Jagabi" Rheostats have many superior refinements, including the Lubri-tact, graphited carbon lubricator brush which slides with a phosphor bronze current-carrying brush—no scratching or sticking on the resistance winding even at high temperatures. Solid wall porcelain tubes assembled by expert workmanship, with precise adjustment and control, combine to make "Jagabi" a sturdy long lasting construction.

Among the many varieties manufactured by James G. Biddle Co. craftsmen are screw

drive rheostats, double rheostats with one or two sliders, water cooled rheostats, graded rheostats up to 24" long with different sizes of resistance wire, switchboard rheostats, rheostats in metal cages, and non-inductive rheostats.

Bulletin 41-ECM is a thorough description of "Jagabi" Lubri-tact, as well as "Jagabi" Compression Carbon Rheostats for controlling heavy current... also "Jagabi" Resistance Units. Your request will bring this booklet by return mail.

Is Your LITERATURE FILE Up to Date?

The bulletins offered here will be mailed at no obligation. Just check this handy form and have it mailed with your name and address.

25-80-ECM 41-ECM 24-25-ECM

Complete list of latest Bulletins.

We are constantly publishing new technical bulletins on Biddle Instruments. A complete list of our latest bulletins will be mailed you on request, so that you may check it to bring your files up to date.

James G. Biddle Company
1316 Arch Street, Philadelphia 7, Pa.

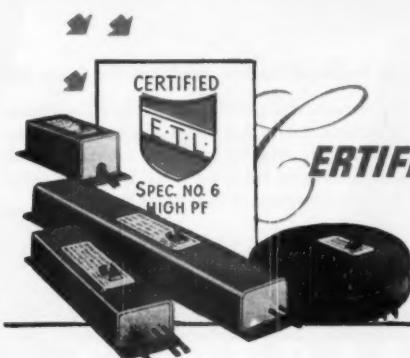
HOW TO GET 1,000 HOURS MORE LIFE FROM A Fluorescent lamp!

THE life of 40-watt fluorescent lamps can be shortened as much as 1,000 hours by improperly designed ballasts.

You can avoid this costly loss . . . save on lamp replacement and maintenance . . . by specifying the ballasts that assure you full rated lamp life . . . **CERTIFIED BALLASTS!**

CERTIFIED BALLASTS are made to exacting specifications, then tested, checked and certified by an impartial authority, Electrical Testing Laboratories, Inc.

Up to the minute information on the types of **CERTIFIED BALLASTS** available from each participating manufacturer may be obtained from Electrical Testing Laboratories, Inc., 79th St. and East End Ave., New York, New York.



CERTIFIED BALLAST MANUFACTURERS

Makers of Certified Ballasts for Fluorescent Lighting

2116 KEITH BLDG., CLEVELAND 15, OHIO

MAIN PROBLEM
MOISTURE?

WATERTITE - 500,000 CM - RW - 600 V

SOLVE IT WITH

HAZARD WATERTITE!

Hazard Watertite offers you a long-lived insulation with high dielectric strength that's effectively impervious to moisture. It's tough, elastic and free stripping. In wet locations, Hazard Watertite speeds and simplifies installation as no protective lead sheath with costly, time-consuming joints and terminals is needed. Since its earliest development as Submarine insulation for non-metallic sheathed underground cables, Watertite has a history of over 20 years in trouble-free service. Approved under NEC as Type RW for use in wet locations without metallic sheath, or Type RH for use at a maximum conductor temperature of 75C.

MAIN PROBLEM
HIGH VOLTAGES?

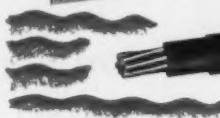


BE SAFE WITH

HAZARD KEYSTONE!

Hazard Keystone, field-proved over the past 50 years, is an oil-base insulation for high-voltage installation. It combines in one compound — resistance to ozone, corona, moisture, heat, sunlight, mildew, acids and chemicals. Your assurance of long, trouble-free service from aerial, underground or interior cable installations with Hazard Keystone insulation is backed by its long, successful service record as well as thorough factory testing which includes both a-c and d-c tests for service over 5000 volts.

MAIN PROBLEM
HEAT?



YOUR ANSWER IS

HAZARD PERFORMITE!

Specially developed to withstand the deteriorating effects of heat on insulation, Hazard Performite gives you an ideal answer to this difficult installation problem. Since 1931, this Hazard insulation has been used extensively for all kinds of general interior circuits, branch feeders, portable cables, municipal cables and other special installations demanding long, trouble-free service life and exceptional heat resistance. Performite is long-aging, non-corrosive, free-stripping, mechanically and electrically stable. Approved under NEC as Type RH for use at a maximum conductor temperature of 75C.

THE RIGHT
WIRE OR CABLE
FOR ANY JOB
STARTS WITH THE
RIGHT
INSULATION...

There's a Preferred Hazard Insulation for Every Job

For full information about Hazard Watertite insulation write for Bulletin H-422; H-403A gives all the facts about Keystone and H-431 about Performite or ask your Hazard representative. Hazard Insulated Wire Works, Division of The Okonite Company, Wilkes-Barre, Pa.

HAZARD

Insulated wires and cables for every electrical job



8045

..... IN HOMES TOO

WITH G-E TRIGGER-START BALLASTS



instant start
BALLAST

lamps light INSTANTLY!

GENERAL ELECTRIC

**NO STARTER
NO DELAY**

This Tag Sells the Story

Now, G-E trigger-start ballasts for 14, 15, 20, and 32-watt (circline) standard lamps provide instant starting in residential fixtures. And a new two-lamp trigger unit is available for standard 20-watt lamps. So now, whether it's a residential, commercial, or industrial fixture, let this tag be your sign of top quality ballasts—let it help you sell the story of better lighting, instantly.

Save Lighting Dollars!

The **BEST** in modern lighting calls for the **BEST** in lighting accessories. These General Electric components provide day-in, day-out operation that spells long-run economy—that saves lighting dollars.



M AND D TRANSFORMERS FOR LIGHTING CIRCUITS

Now you can get special lighting transformers at the same price as conventional units! These units, equipped with two 5% rated-kva taps below rated primary voltage, can be used to compensate for a 5% or 10% drop in line voltage, thus providing rated voltage to the lamps. There are 11 sizes from 1 to 50 kva, rated 480 volt primary, 120/240 volt secondary. Ideal for your new lighting job, or if you are not getting full light output from your present system. A complete line of these units with 600 volt primary is also available, at a slightly higher price.



BALLASTS FOR MERCURY-VAPOR LIGHTING

For lighting high-bay areas, mercury-vapor lamps provide both economy and efficiency. General Electric Tulamp ballasts make economical mercury vapor lighting cost even less. This popular Tulamp unit powers two lamps at high power factor, giving steady, abundant light. It costs less than two single-lamp units, cuts installation and operating costs. There's a complete line of G-E mercury-vapor lamp ballasts to meet virtually any installation requirement.



BALLASTS FOR FLUORESCENT LAMPS

The heart of a fluorescent fixture is the ballast. The design and construction of the ballast can affect lamp life, lamp light, and the life of the ballast itself. All General Electric ballasts are designed and built to give correct voltage and current for the lamps they operate—to provide rated lamp output and full lamp life. For the most for your lighting dollar, specify G-E ballasts in the fixture you buy. Buy when you see the familiar General Electric ballast tag on a fluorescent fixture. Apparatus Department, General Electric Company, Schenectady 5, N. Y.

GENERAL ELECTRIC



411-81

The 60-second gold mine!

60 SECONDS MAKE A MINUTE . . . minutes run into hours and into *money* before you know it! And that's why Gedney Fittings are the best buy obtainable today. Gedney Fittings are machined with absolute accuracy. They'll save you the minutes that can add up to hundreds of dollars of a workman's time—each year!

GEDNEY FITTINGS FIT!

- ★ Accurate castings of malleable iron . . . no breakage.
- ★ Threads cut true . . . perfect conduit alignment.
- ★ Designed to fit . . . vibration cannot work it loose.



GEDNEY
ELECTRIC COMPANY



RKO BLDG. • RADIO CITY • NEW YORK 20
Foundry, Factory and Shipping Point: Terryville, Conn.



You Can SAVE Space
and Reduce Inventories

with

TRIANGLE'S "DUAL-RATED" WIRE

The Same Stock
in
Half The Space!
"DUAL-RATED!"



It's the insulation that Counts!

This remarkable new Triangle insulation is expertly compounded to stand up under the extremes of heat or moisture (RH at 75° C., dry locations; RW at 60° C., wet locations). It incorporates the qualities of the old Type RH and Type RW insulations.

In the long run — you'll save — and get it faster — from a Triangle Distributor

Can Be Used as Either Type RH or RW
You no longer need two types!

Here's something new—something really new! It's Triangle's "Dual-Rated"—suitable for use in dry locations at 75° C or in wet locations at 60° C. Underwriter's Approved.

Think of the money you save in reduced inventories!

Think of the space you save!

Think of the confusion and the headaches you avoid!

Size #14, Size #12 — right up to 1,000,000 CM — you only need one type.

"DUAL-RATED!"

No need to order two of each size.

UNDERWRITER'S APPROVED!

Underwriter's Laboratories Inc. has approved the use of Triangle's "Dual-Rated" in either RH or RW applications.

Why Buy Two—
When ONE Will Do?

Where it's HOT —

Where it's WET —

You no longer need two types —

Use "Dual-Rated"! It's a remarkable wire. Available in sizes #14-1,000,000 CM. In sizes #14 through #6, the cover is Triangle's revolutionary Glazon—the toughest, easiest-to-work cover on the market.

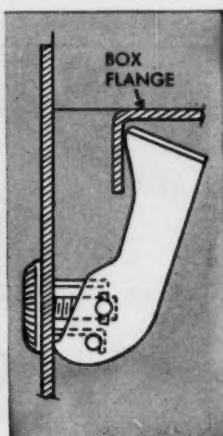
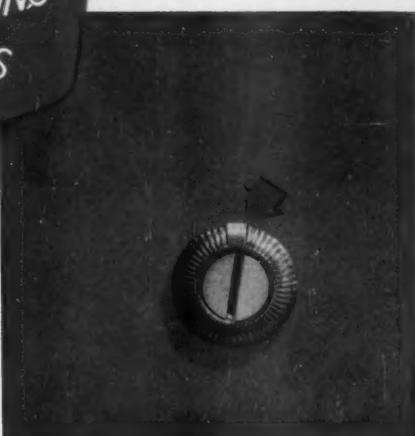
▲ TRIANGLE CONDUIT & CABLE CO., INC.

1908 JERSEY AVENUE • NEW BRUNSWICK, NEW JERSEY



"GLAZON" BUILDING WIRE • BARE WIRE • ARMORED CABLE • "GLAZON" NON-METALLIC SHEATHED CABLE • SERVICE ENTRANCE, SERVICE DROP, VARNISHED CAMBRIC BRAIDED OR LEADED, TRIOPRENE TRENCH, POWER AND PARKWAY CABLES • RIGID CONDUIT HOT-DIPPED GALVANIZED • ELECTRIC METALLIC THIN WALL CONDUIT • FLEXIBLE STEEL CONDUIT

**YOU CAN BE SURE.. IF IT'S
Westinghouse**



Speed panelboard trim installations ...with INDICATING TRIM CLAMPS!

Indicating, adjustable trim clamps? Just a long name for a little device that enables you to install Westinghouse Panelboards *fast!*

A dial-type indicator on the outside of the trim or cabinet front eliminates the need for "x-ray eyes", or working by "feel". The dial shows when the clamp is in the proper position for tightening. A small detail, perhaps, but one that effects a substantial cut in panelboard installation time . . . one that you can measure in terms of dollars saved! Moreover, it's just one of many Westinghouse features that contributes to greater ease in installation. Check these additional "time savers":

Phase Identification on 3-phase, 4-wire lighting panelboards speeds up wiring by eliminating the necessity for "ringing out."

Quick-fasten access plates to slash panelboard assembly time.

Taken separately, these are little things, of course. But collectively they make a big difference in final panelboard costs . . . a difference that will enable you to buy quality-constructed panelboards for every job. And you can be *sure* about quality if it's Westinghouse.

Descriptive Bulletin 30-930 contains complete details. For your copy, write Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania.

J-40387





and here are the reasons why!

TIME AFTER TIME...a dozen times during the last 18 months...there's been news of remarkable new Federal Noark developments in every line of low voltage distribution equipment. And to the electrical trade this has all been *headline news*, telling of opportunities to supply your customers with superior devices and to make unheard of savings of labor and money at the same time.

Today, whatever your requirements may be, you'll find in the Federal Noark line exactly the

right equipment for every job. What's more, all of it will have special features that make it the best value obtainable for ease of wiring and installation and for service efficiency and long life.

It will pay you to look at once into the complete lines of Federal Noark equipment at your nearest Federal Distributor's. You'll plainly see how Federal's development of one new product after another makes it possible for you to save real money and increase your profits.

FOR EXAMPLE, LOOK AT THESE SERVICE ENTRANCE EQUIPMENT FEATURES



Cat. No. 126161

HANDLES MODERN LOADS

Federal's 100 Amp. Main and Range Pull Switch line is a completely new design to handle the increased loads demanded in today's residences.

Main: 100 Amp. fusible pullout, 125/250 V., A.C., 3 wire SN.

Branches: a. Two 60 amp. fusible (or one 60 amp. and one 30 amp.) pullouts, 3 Wire SN for range and water heater.

b. 10 or 16 plug fuses, 2 Wire SN branches for lighting circuits.

c. Also available with 30 amp. "off peak" water heater branch circuit.

Split solid neutral construction places each neutral terminal next to each lighting circuit...Entire interior can be removed for ease of wiring.



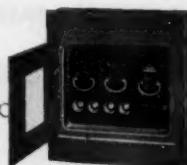
Cat. No. 110

A REAL SPACE SAVER

New Federal Noark 100 Ampere Pull Switch is unusually compact and attractive. Surface and flush enclosures are 12" high x 10" wide...raintight enclosure, 13" high x 10" wide...and all enclosures are only 4" deep...No hinged joints; completely dead front, even with puller head out; "On" and "Off" positions clearly indicated.

"OFF PEAK" CIRCUIT ADDED

Utilities' expansion of "off peak" hot water service has created the need for additional isolated circuit capacity to handle this load. To meet this need, Federal Noark has added a 30-ampere 3 pole SN Pull Switch to its popular 264 and 264C Main and Range Switches...designated by the suffix "W".



Cat. No. 364W

30 NEW QUICKLAG PANELETTES

New and larger capacity enclosures increased the value of the individual pole Quicklag Circuit Breakers for service entrance use.

Now you can get Federal Noark QL Panelettes with:

- ★ Up to 24-circuit capacity.
- ★ 100 Amp. Main Breakers.
- ★ Special polarity sequence bussing allowing maximum number of double pole breakers.
- ★ Bussing that allows full advantage of multi-main provisions of N.E.C. to eliminate the need for large main disconnects.
- ★ Panelboard-type doors and locks.
- ★ Rauntight enclosures.

Only Federal Noark supplies this complete range of QL Panelettes.



Cat. No. 167FD2508



SIMPLEST, SAFEST, CIRCUIT BREAKER PROTECTION

Federal Noark's amazing new STAB-LOK Circuit Breaker system will replace practically all popular fusible devices—and at comparable cost. The 1, 2, 4, 8, and 16-circuit STAB-LOK Circuit Breakers are suitable for service entrance use. Additional circuits are safely, easily added merely by plugging-in breakers and connecting load wires.

SEND FOR COPY OF OUR NEW PRODUCTS BULLETIN

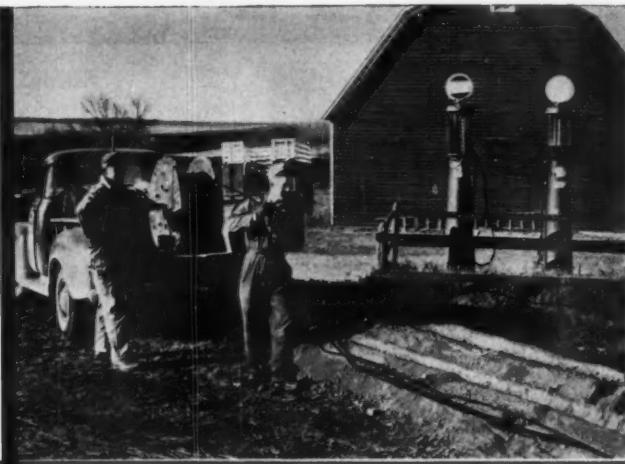
FEDERAL ELECTRIC PRODUCTS COMPANY, 50 PARIS ST., NEWARK 5, NEW JERSEY



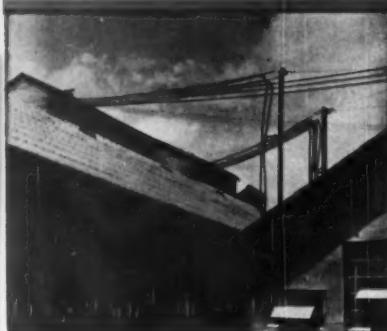
FEDERAL NOARK
Service Entrance Equipment

Complete line of Federal Electric Products includes Motor Controls, Safety Switches, Service Equipment, Circuit Breakers, Panelboards, Switchboards, Control Centers, Bus Duct * Sales offices in principal cities

UNDER A FARM . . .



. . . OR OVER A FACTORY



The most dependable cable you can install has a jacket of Neoprene

Even in areas where conditions are unusually destructive, neoprene-jacketed cable stays on the job. Overhead, it resists the smoke and chemical vapors of industrial districts . . . isn't damaged by intense sunlight . . . will not rot and festoon. Underground, the neoprene jacket protects cable against acid or alkaline soil. It withstands the deteriorating effects of galvanic action—and particularly important near farm structures, it resists moisture, fungus and ammonia-laden air.

So next job, make sure you use cable designed for long, trouble-free service—with a jacket of Du Pont neoprene. Although Du Pont does not make neoprene products, leading wire and cable manufacturers use neoprene for their quality constructions. Your distributor can supply you. And if you'd like to read about new neoprene applications that may help you, we'll put you on our mailing list for "The Neoprene Notebook." Write: E. I. du Pont de Nemours & Co. (Inc.), Rubber Chemicals Division T-10, Wilmington 98, Delaware.

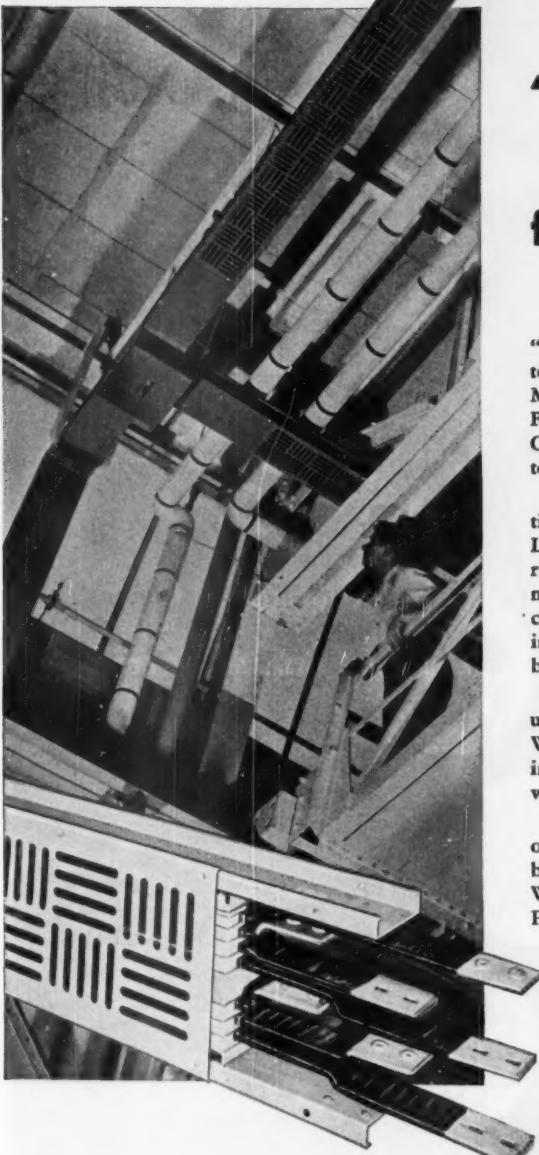
NEOPRENE

Now made famous by Du Pont since 1932



Tune in Du Pont "Cavalcade of America"—Tuesday evenings
NBC—coast to coast

YOU CAN BE SURE.. IF IT'S
Westinghouse



"Low Impedance **BUS DUCT** for the Long Run"

"We've found Westinghouse low impedance bus duct to be ideal for long transmission runs in a plant," say Mr. R.W. Holicky, Chief Engineer, and Mr. W.F. Nock, Field Supervisor, of the Doan Electric Company in Cleveland. "It's easy to handle and no trouble at all to hook up."

Let bus duct answer *your* secondary power distribution problems—whether you're building or expanding. Low impedance bus duct provides required voltage right out to the end of your system . . . keeps lights, motors, and other equipment functioning at top efficiency. In addition, it packs greater carrying capacity into a smaller space than either conduit or wire. And bus duct means reduced maintenance.

Completely pre-fabricated sections can be installed up out of the way of plant traffic—quickly and easily. What's more, the sections can be disassembled immediately and rushed to new locations with no wiring mess to unravel.

Ask your Westinghouse representative for the facts on dollar and space-saving bus duct. Descriptive bulletin B-4271 contains further information. Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania.

J-30042



Westinghouse
BUS DUCT

ELECTRO cuts 1 man out of 2 from your installation picture!



- Exclusively ELECTRO'S—the patented ONE-MAN SPEEDY HANGER
- Saves 3 men to install ELECTRO fluorescent luminaires
- Saves thousands of costly man hours
- Simple and positive in operation
- Dramatically reduced maintenance costs

Discover this new, proven way to reduce your installation man hours 50%. Specify your choice of ELECTRO COMMERCIAL fluorescent fixtures. All are adapted to ELECTRO'S cost-saving "one-man" SPEEDY HANGER—at no extra cost to you!

3 EASY STEPS¹

STEP 1

Push fixture suspension clips onto Speedy Hanger—no tools required.

STEP 2

Slide fixture suspension clips onto fixture Speedy Hanger and secure with spudger.

STEP 3

Push fixture suspension clips and fixture into Speedy Hanger hole. Lift fixture firmly and slide T wing nuts.

—THAT'S ALL!



ELECTRO MANUFACTURING CORPORATION

2000 W. Fullerton Ave., Chicago 12

Chicago 12

1 Show him how master selector switch can be placed in front entrance hall, to provide over-all control of lights and outlets. Gives him a strong talking point the minute a prospect enters.

2 Suggest master selector switch for master bedroom. Tell him home buyers are excited about the idea of controlling fans, coffee makers, and lights right from bedside.

3 Explain the pathway-of-light idea. Help him plan so that home owner can light his way through his house, turning lights ON and OFF as he goes—with G-E remote control switches.

4 Remote control permits practical extension of the usual two-point control of cellar or attic light by providing a switch at the bedside, for these often forgotten lights . . . a strong selling point.

5 For outside lights, porch lights, bungalow lights, garage lights—remote control is a natural. Control them from entrance hall, rear door, and at the lights, themselves.

5 good suggestions

TO HELP A MERCHANT BUILDER ...AND YOURSELF

Merchant builders are interested in the sales possibilities of the General Electric remote-control wiring system. You'll be interested, too, once you've shown your local builder this new master selector switch.

This new switch is the sales ammunition you've wanted for years. It's something new and different you can use as a talking point. It's something your builder can actually show his prospects.

Pick up one of these new master selector switches from your General Electric distributor. Show it to your builder, and explain how this feature will attract prospects for new homes. It means a small added investment to him—extra business for you on every house.

It will pay you to be first in your community to offer the General Electric remote control wiring system. See your General Electric distributor now for all the facts, or write to Section D6-1018, Construction Materials Department, General Electric Company, Bridgeport 2, Connecticut.

You can put your confidence in—
GENERAL  ELECTRIC

ADVERTISEMENT

More Business—More Profit—for Contractors

NOCRETE
WITHOUT CONCRETE
ENCASING

VOL. 1 NO. 4

ORANGEBURG

Fibre Conduit News

STANDARD
WITH CONCRETE
ENCASING

OCTOBER 1950

CONTRACTORS AGREE—THIS CONDUIT LAYS FASTEST AND AT LOWEST COST!



From the minute the first length is loaded on the truck till the final length is laid in the trench, ORANGEBURG CONDUIT saves time, work and money for the contractor. And once laid, this high quality conduit provides a safe, permanent underground cable raceway.

STANDARD is Profitable

For banks of three or more ducts, remember that ORANGEBURG STANDARD is the first choice of leading utilities, municipalities, industries, contractors and design engineers all over America. This nationwide approval is due to Orangeburg's quality and dependability and its profitable ease of installation.

NOCRETE is Profitable

For the many single or double duct runs where it is practical to install *without* concrete encasement, use ORANGEBURG NOCRETE. NOCRETE is specifically designed with extra heavy wall for direct burial *without* concrete encasement. It is used with profit for installing the underground electrical services of . . . factories, schools, colleges, hospitals, drive-in theatres, power, telephone and other communications systems . . . also service entrances, parkway and suburban lighting, airport lighting and communication.



LOW COST FAST INSTALLATIONS

Orangeburg Conduit is easy and economical to lay. Moreover, it gives permanent protection to

cables. Its impermeable wall keeps out corrosive ground waters—resists acids, alkalis, salt, grease and oil. Orangeburg Conduit is tough, resilient—no cracking or breaking when properly handled.

NOW BRANDED WITH
ORANGEBURG
TRADEMARK

FASTER, CHEAPER HAULAGE



By combining light weight with ample strength to resist breakage, Orangeburg Conduit can be hauled in capacity truck loads without damage and with fewer trips between distribution point and location. Result—transportation costs cut to minimum and job gets started faster.

EASY TOOLING ON JOB MAKES JOB MORE PROFITABLE



Orangeburg is easily tooled on the job. It can be sawed readily to any length. It lightens work for the crew—increases the contractor's savings and net profits.

TAPERSLEEVE JOINTS SAVE TIME AND MONEY



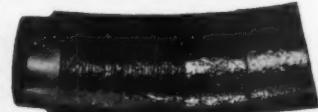
Assembly with Tapered Sleeve Joints is surprisingly simple and fast. You merely place coupling on conduit taper and a few light taps drive it home. You get a permanently watertight joint and save money making it.

Light Weight Holds Down Handling Costs



With Standard 4" weighing only 2 pounds and heavier-walled Nocrete but 3.6 pounds per foot, Orangeburg handles fast both above ground and in the trench—all at important cost savings.

Send for Free Bend Section Folder



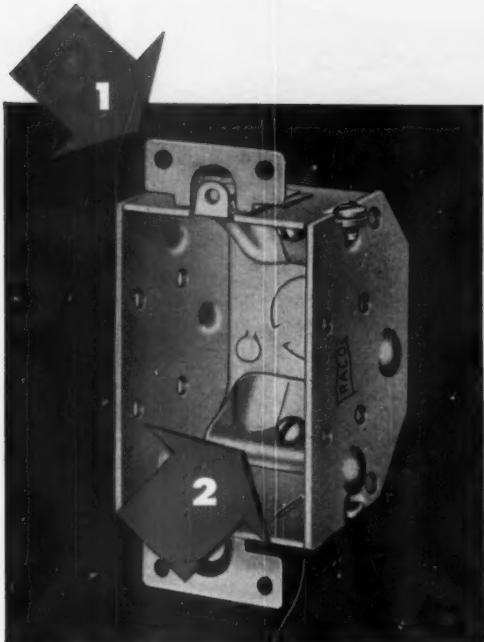
Illustrated folder—showing various types of Orangeburg Bend Sections and Angle Couplings—sent FREE on request. Write today to Dept. EC-10, Orangeburg Manufacturing Co., Inc., Orangeburg, N. Y.

ORANGEBURG MANUFACTURING CO., INC., ORANGEBURG, NEW YORK

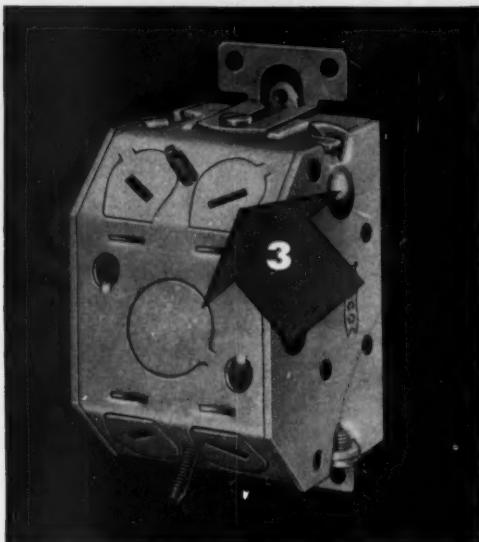
GENERAL ELECTRIC
SUPPLY CORPORATION

DISTRIBUTORS,
ORANGEBURG
FIBRE CONDUIT

Graybar
ELECTRIC COMPANY



BLOS—Front view



BLOS—Rear view

Here's the nation's most popular switch box . . . with 3 basic, new improvements

1 First of all, we've given it one-screw ears. And these are built as they should be for a secure mount. They are of heavy metal and slide between long, strong embossments in the box, which hold the ears in perfect alignment. They are adjustable to *all* wall thicknesses. And, of course, the one screw means easier, faster adjustment.

2 Next, we've completely redesigned the clamp to give it firmer clamping action. We've also

relocated its screw so that it projects through the bevelled side of the box where it is completely out of the way.

3 Finally, we've relocated the slots in the knockouts so that knockouts can be removed with a single, smooth movement of arm and wrist. We've also broken the knockout circle design to give them flat bottoms for improved cable clearance.

RACO

ALL-STEEL PRODUCTS

ALL-STEEL EQUIPMENT Inc.—800 Kensington Ave., Aurora, Illinois

YOU CAN ALWAYS RELY ON RACO



"Marshalling the forces of advertising to help solve national problems and to make democracy work better . . ."

DO YOU KNOW that the forces of advertising are engaged today in one of the world's greatest jobs of mass education . . . in the public interest?

Do you know that these forces for good have been released through the vision and unselfish cooperation of American business — advertisers, advertising agencies, media owners and others?

Hundreds of advertising agencies have volunteered their planning and creative time and facilities. Artists, cartoonists, photo-engravers, printers, typographers and others have contributed their services.

Media owners have donated millions of dollars in space and time. National and local advertisers have sponsored and paid for many millions of public service advertising messages.

As a result, the American people are being alerted as never before to the dangers which threaten from within and from without . . . the dangers of ignorance about our American economic system, intolerance, tuberculosis, school and teacher shortages, etc.

And, at the hub of this great public service effort is *your* organization . . . The Advertising Council.

Advertisers and Media Owners... Your Help is Needed!

Right now The Advertising Council has 14 programs in operation. The success of these programs depends on the public spirited and generous cooperation of advertisers and media owners. *Your* help, in the form of space or time donations,

will mean a lot to us. And remember . . . *What helps America helps you!*

Yours for the Asking

Write for a copy of Booklet No. 15. It will give you pertinent information about The Advertising Council . . . how it started . . . what it is . . . what it does . . . Or ask for material on specific campaigns. Address:—The Advertising Council, 25 West 45th Street, New York 19, N. Y.



*Published in the public interest
by
ELECTRICAL CONSTRUCTION
& MAINTENANCE*

* A NON-PROFIT ORGANIZATION FORMED TO UTILIZE ADVERTISING IN THE PUBLIC GOOD

Call your Central Conduit distributor

HE HANDLES

**THESE Four
Famous Raceways**



Your Central Conduit Distributor handles quality products. That's why he sells and recommends **Central Rigid Steel Conduit**. It's made in four different types to provide you with an electrical raceway that will exactly fit your needs.

Cenlaco has a hot dipped galvanized and lacquered finish. **Central White** has an electro-galvanized outside finish and a black enameled inside finish. **Central Black** has a permanent, baked-on enamel finish inside and out. **Central EMT** is a light-weight conduit with an electro-

galvanized outside finish and has a durably lacquered inside finish.

In addition to quality products, you can depend on your Central Conduit Distributor for friendly service. He'll go out of his way to see that you are fully satisfied.

Unprecedented demand has made it impossible at times for him to always completely fill your orders immediately. But keep in touch with him. He will make sure that you get a fair share of his supply.

SPANG-CHALFANT

Division of The National Supply Company

General Sales Office: Grant Bldg., Pittsburgh, Pa.
District Offices and Sales Representatives in Principal Cities



CENLACO a hot dipped galvanized and lacquered finish, inside and out.

CENTRAL BLACK

CENTRAL BLACK permanent, baked-on black enamel finish, inside and out.

SPANG

CENTRAL WHITE

CENTRAL WHITE electro-galvanized outside and black enameled inside.

SPANG-CHALFANT
RIGID STEEL CONDUIT

CENTRAL ELECTRICAL METALLIC TUBING

EMT—Light-weight electro-galvanized outside and durably lacquered inside.

CRESCE NT ENDURITE

New!
Improved!

DUAL PURPOSE WIRE & CABLE

• In DRY locations ENDURITE Insulated Wire & Cable is rated as a Type RH with its higher permissible operating temperature and consequent greater current carrying capacity.

• In WET locations this same wire with its excellent moisture - resisting qualities is rated as a type RW.

• Except where voltage drop is the determining factor, ENDURITE when used as a type RH allows greater current-carrying capacity, so smaller size of cable and in many cases smaller size of conduit can be used at less cost than would be required for Type R or Type T or TW for the same load.

• CRESCE NT ENDURITE when used in sizes #6 A.W.G. and larger in dry locations will in most cases give the lowest installed cost per ampere of useful circuit capacity.



CRESCE NT WIRE & CABLE

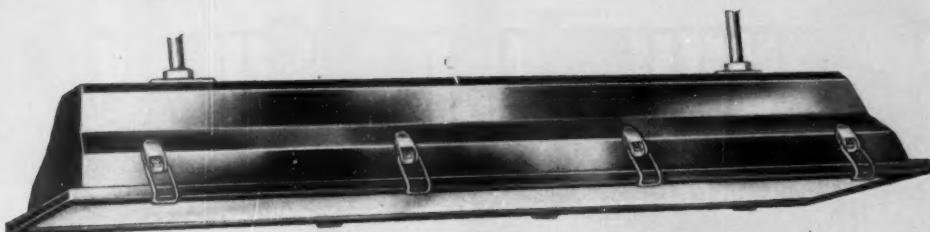


CRESCE NT INSULATED WIRE & CABLE CO.

TRENTON, N. J.

HELP!

...Yourself to
greater Lighting Efficiency



Wheeler GLASS-ENCLOSED FLUORESCENT FIXTURES

FOR SEVERE SERVICE CONDITIONS

DUST-TIGHT

FOR HAZARDOUS LOCATIONS

Designed for use wherever combustible dust atmospheres exist, such as those containing flour, starch, grain dusts, carbon black, coal dust, or easily ignitable fibres or flyings.

VAPOR-TIGHT

FOR NON-HAZARDOUS LOCATIONS

The ideal unit for use in food plants, printing establishments, and wherever non-combustible atmospheres exist. Its efficiency soundly proved in actual operation. Easily installed, economically maintained!

For complete information write Wheeler Reflector Co.,
275 Congress Street, Boston 10, Massachusetts

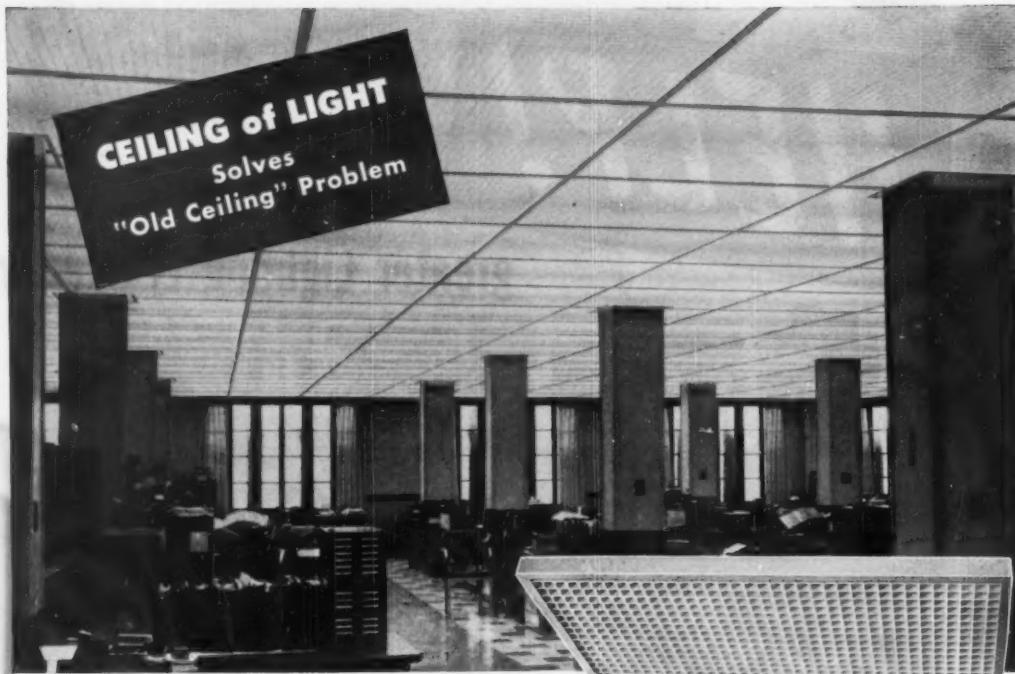
Wheeler REFLECTORS

Distributed Exclusively
Through Electrical Wholesalers

MADE BY SPECIALISTS IN

"SKILLED LIGHTING"

EQUIPMENT SINCE 1881



Leaderall moulded plastic unit ceiling at Electric Supply Corp., Chicago. Approximate area 6,000 sq. ft. Average intensity 50 foot candles . . . light intensities may be varied, however, without visual effect. Indicated framed area of 4 sq. ft. Light source is simple, fluorescent strip with reflectors. Architect . . . Mr. Vic Charn.



An ideal Leaderall installation would consist of fluorescent slimline strip with reflector mounted to ceiling, plus Leaderall plastic ceiling grille installed below. Leaderall grille is easily removable for quick relamping. Grilles provide more apertures per foot for maximum "sifting" of lamp rays and greatest shielding of lamps. Units with 40°-40° cut-off available in 2' x 4' or 4' x 4' sections. Other sizes and curvatures custom made. Plastic is destaticized . . . dust resistant. No interference with sprinkler system or air conditioning.

Leaderall

Illuminated Ceilings ... Modernize, Beautify

Spreading a soft glow of even light from wall to wall, Leaderall ceilings simplify decorative planning two ways: They add a cool, quiet modern note to the completed decorative scheme! They cut remodeling costs by permitting old ceilings to be used without change!

EASY TO INSTALL —

Section after section of Leaderall moulded plastic units are hung on adjustable tie rods at any desired distance from present ceilings. New ceiling is absolutely even . . . All reconstruction costs normally due to different ceiling levels or other structural difficulties are avoided! Write for full information.

Sold and installed only by the better electrical wholesalers and contractors

Leader America's No. 1 Lighting Equipment Manufacturer

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OCTOBER . . . at a Glance

Red Feather—A Business Responsibility

The importance of business help and endorsement of this month's Red Feather campaign has been well stated this year by the two Charles E. Wilsons, who head two of the world's greatest enterprises, General Motors and General Electric.

"We believe in the 'many in one' campaign idea. . . .

This year, Community Chests are uniting more than 15,000 health and welfare agencies in one big effort to raise approximately \$190,000,000. This is to help finance such typical Red Feather services as Boy Scouts and Girl Scouts, Maternity Homes, and Visiting Nurses, Family Service, Travelers Aid, Neighborhood Houses and Legal Aid. Included too, are Boys' Clubs and Camp Fire Girls, Urban League, Children's Aid, Hospitals and Clinics, and Services for the Aged. The Salvation Army, Y.M.C.A., Y.W.C.A., Summer Camps, Clubs for Girls, Aid to the Handicapped and Social Hygiene services are also members of the Red Feather family.

"Being businessmen, we see the advantage of uniting these many campaigns under one efficient, fund-raising organization. Industry knows that production costs drop as volume increases. Over 30 years' Chest experience proves that coordinated campaigns cost less, save time and energy and raise more money to provide more and better services. Big or small, federated campaigns guarantee effective use of the funds subscribed. They substitute order for the chaos that comes with many separate fund-raising efforts.

"Proof that the 'many in one campaign' is effective lies in the fact that appeals are being federated in more and more local communities. Leaders of both management and labor, in civic clubs and governmental departments, from professional circles and educational groups, are giving increasing endorsement to the idea of joint campaigning and budgeting.

"The number of communities organizing Chests has steadily increased. In 1940 there were 561 reported Chests. By 1948 the number had grown to 1060. At the present time definite information is available

about Chests in more than 1250 cities.

"Federated drives raise more money for the participating agencies than they raise separately. No city has ever reported that it raised less money for its needed services in a federated campaign than the agencies secured independently in separate appeals. On the contrary, seven cities holding their first Community Chest campaigns last year, actually raised an average of 87.3 percent more than the health and welfare agencies had raised in previous years by individual efforts. This successful 1949 experience with first Community Chest campaigns has been duplicated in hundreds of communities over the 37-year history of Community Chests. "United campaigns are wisely planned, cooperative undertakings. We believe they make sense and should be supported generously by all thoughtful businessmen."

Lighting Progress

Each year at about this time we devote a special editorial feature section to one of the aspects of modern lighting. Through the years, lighting, and the wiring necessary to serve it, is absorbing an ever larger percentage of the electrical construction market, and of the industry's efforts. A measure of this progress, in terms of market potentials, is presented this month together with typical case studies of lighting systems which offer bench marks of current lighting application method. Lighting 1950 begins on page 63.

New Construction

According to an industry report released by the Department of Commerce, the volume of residential construction may be cut as much as one-third in 1950 as a result of tighter credit policies. However, the report goes on to say that the overall physical volume of new construction is still low compared with expansion in other sectors of the economy, and curtailment of construction will result in only modest savings of such materials as steel, copper and aluminum.

Construction uses account for only about 14 percent of current steel pro-

duction, (ingot tonnage), not more than 5 percent of copper production, and about 10 percent of aluminum production. If estimated increased military steel requirements will amount to 8 million more tons, a proportionate contribution by the construction industry would entail a reduction of less than 10 percent in construction activity.

In July, the value of construction in place went right through the top of the chart to a monthly total of 2,659 millions of dollars, or 25 percent over the same month last year.

In spite of what seem to be very high levels of construction activity, it is interesting to note that overall physical volume in 1950 will be only about 3 percent over 1926 and 1927 levels. Total private construction is still under the volume of the mid 20's in spite of the large number of new homes this year.

Vertical Bus

Use of bus systems for risers in multi-story commercial buildings presents some interesting features of design and installation. Macy's new store in San Francisco which establishes some new electrical superlatives for the Bay area, uses busway feeders for vertical distribution as well as horizontal runs, some set flush with finished ceilings. Fay Lemoge, of Lemoge Electric Company in San Francisco tells us about some of the job features in "Store Distribution by Vertical Bus" on page 55.

Unit Costs

In the series, "How to Estimate Electrical Work", the emphasis so far has been upon estimating methods and procedures. Beginning with this month's installment, we take up a subject which a great many of our readers have requested, unit labor costs. They are presented against the background of the preceding articles and it is hoped that the reader, if he has not followed the series, will go back to the first article which appeared in January, and the succeeding articles, before attempting to use or apply the labor unit data. And, of course, no set of such data should be used without careful checking against actual performance records.

announcing: the new SILVALINE

Service Entrance Cable—
Type SE With True URC
WEATHERPROOF Protection



To complete your information on the new Silvaline* URC-Type SE Weatherproof Service Entrance Cable, contact your nearest Anaconda Sales Office or Distributor.

Anaconda Wire & Cable Company,

25 Broadway, New York 4, New York.

Now, Anaconda gives you a completely new Service Entrance Cable that provides greater dependability, longer life, higher resistance to weather, with these 4 features . . .

1. **TRUE URC SATURANT** and Finish provide durable fibrous covering with excellent weathering properties.
2. **TOUGH NEOPRENE TAPES** cover each individual conductor — increase resistance to heat and weather . . . in 2 colors, black and red—give the preferred means of colored conductor identification.
3. **GLASS AND COTTON** combination over-all braid covering provides high resistance to deterioration and adds to life of covering.
4. **SILVER-FINISH COATING** provides for clean handling and an attractive surface . . . makes a greatly improved base for house paint—permits use of URC Saturant and Finish without discoloring externally applied paints.

The right cable for the job

ANACONDA®
WIRE AND CABLE



House Wiring Standards

HOW SOON AND HOW MUCH controls will bite into housing is not yet apparent. But it is fairly certain they are coming soon. And a notable portion of our market for wiring will be affected.

IT IS A GOOD TIME to take stock of what has happened in house wiring. In spite of curtailed volume, maybe we can find out how residential wiring can be installed with some chance of keeping pace with advancing electrical utilization in the future.

IN THOSE AREAS where Adequate Wiring promotion has found contractor cooperation, it has served well. But left to minimum standards and minimum price considerations, house wiring systems fall far short of what the home buyer has a right to expect.

AN IMPRESSIVE, well coordinated campaign for modern home lighting design is just being announced. In a demonstration unit, we counted nine lighting outlets for a dining and living room area where, at the most, the ordinary house may have two, and more frequently one. The same layout would need six switches and preferably more.

SUCCESSFUL PROMOTION of functional home lighting will have an enormous impact on current wiring standards. Maybe it is just what the industry needs to jar it loose from its predominant concern with how to trim another few dollars off the wiring contract.

IN THE SMALL 1000 to 1500 square foot home which comprises the bulk of recent single occupancy house building, the problem is most acute. Builders want cheap wiring contracts. But owners want electrical appliances, devices and lighting in profusion, regardless of the size or cost of the house.

MODERN HOME UTILIZATION demands require wiring systems designed in terms of electrical living standards. Areas, space, or arbitrary ratios of wiring cost to total building cost are matters of very minor concern when it is evident that the owner is very likely to install a range, water heater, automatic laundry, dishwasher and other major appliances. And beyond those appliances which are in great demand today, it is entirely logical to assume that others may command wide public acceptance in the early life of the wiring system.

THE UTILITY INDUSTRY confidently predicts a doubling of residential utilization in ten years. Current wiring practice in new homes should reflect in wiring standards, in capacity and accessibility, an equally confident outlook.

William T. Stuart

Keep Business Buzzing

with signaling via Graybar

Show your customer how, with a flick of a lever, he can "buzz" or talk to anyone, anywhere in his plant. Point out that clear, fast communication among various departments saves many hours of time ordinarily lost in locating personnel, issuing urgent orders and checking operations. Then remember that Graybar has all the voice or code-paging equipment you need to fill your contract quickly and efficiently.

From "intercom" to siren

There's Webster Electric Teletalk, an amplified communication system that connects him directly with personnel at selected points in his plant. It relieves switchboard congestion and saves countless steps through two-way or multiple inter-office conversations. There's the Edwards Lokator, a paging system that speeds location of personnel throughout the plant. Installations can be made with a wide variety of signals — from buzzers, musical notes or silent flashing lights to bells, horns, or howlers that will penetrate any plant noise. Or he may like UIS Sound-powered Telephones. For common or selective talking systems, these handsets transmit distortion-free conversations over long circuits without external power! A rugged weatherproof set is available with magneto howler signals. For warning, Graybar has Benjamin and Federal sirens. The coupon below will bring you details.

Expert help in planning

There are Graybar offices in more than a hundred cities. Your local Graybar Representative will give you complete information on all types of talking, calling, warning, and locating equipment. A Graybar Signaling Specialist will gladly work with you in choosing the best combination of devices and accessories for any installation. We offer you similar service in the selection and procurement of supplies for lighting, wiring, ventilation, and other electrical installations.

Send coupon for folder

GRAYBAR ELECTRIC COMPANY, INC.
420 Lexington Ave., New York 17, N. Y.

Please send me your free illustrated folder, "Signaling and Intercommunication Systems for Every Need."

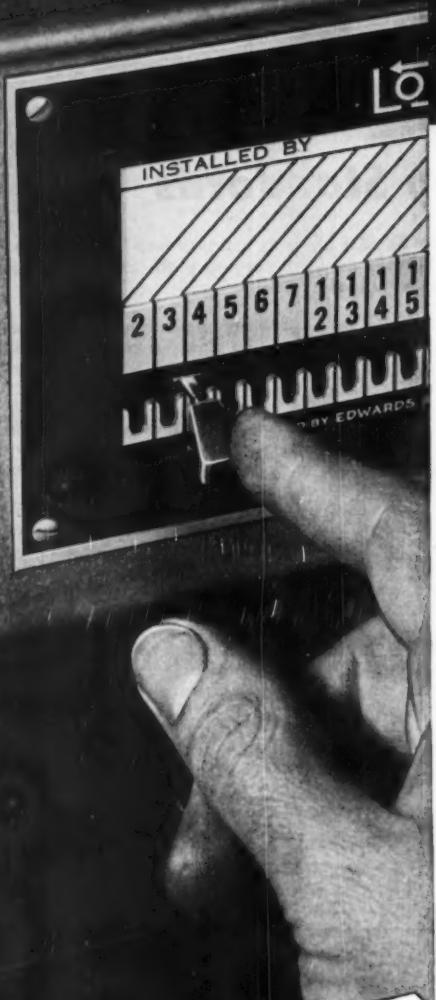
5054

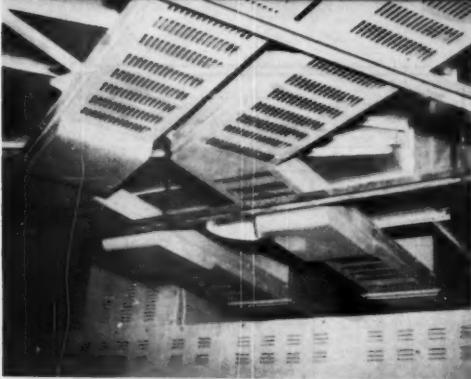
Name _____ Title _____

Company _____

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You get the best of
everything electrical
Via Graybar





HORIZONTAL FEEDER RUNS are suspended from basement ceiling and radiate from switchgear to riser shafts and panel locations. Trumbull LVD busduct installation was a precision job.

STORE DISTRIBUTION By Vertical Bus

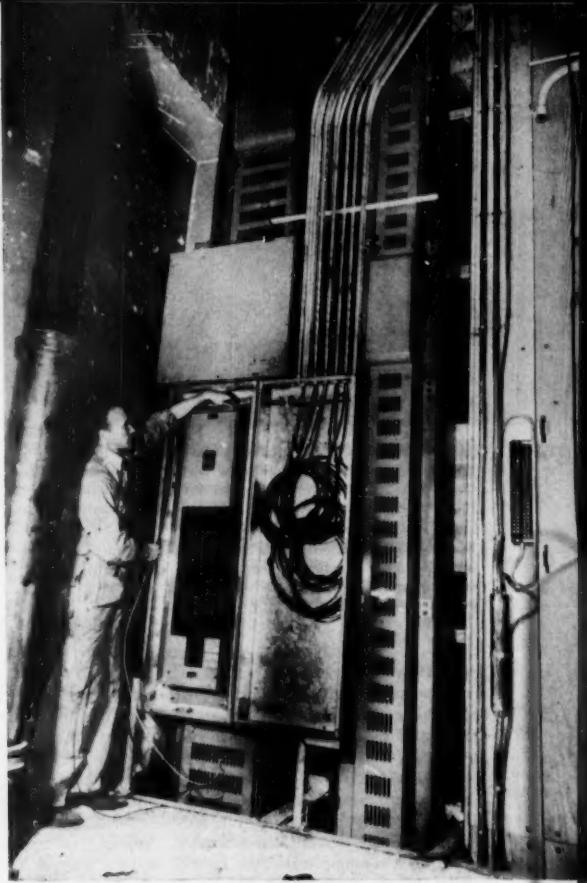
By Fay Lemoge
Lemoge Electric of San Francisco

Electrical adequacy and distribution flexibility stressed in the design of Macy's modern San Francisco store. Load distributed on vertical bus.

WIRING of Macy's new San Francisco department store, sixth link in a strong national merchandising chain, includes the city's largest switchboard, a vertical enclosed bus bar distribution system, automatic controls for heating, ventilation and emergency lighting, photocell traffic monitors for delivery trucks, and 30 footcandles of general illumination. Combining the renovation of an existing 9-floor building with the construction of a large new 8-floor addition, the store includes a floor area of 445,000 square feet; the result of a 3-year building program with uninterrupted merchandising operation in progress.

From service entrances to every section of the merchandising layout, two considerations governed design: adequacy and flexibility. This was stressed by Macy's vice president E. L. Molloy, "In the department store business we cannot take chances with power outages or potential fire hazards. We must also plan for expansion. That's why we want our power distribution system to be safe, to have adequate feeder and branch-circuit capacity, and to have flexibility".

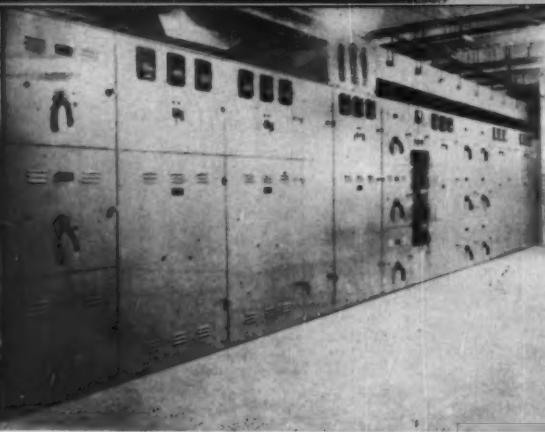
A design figure of 7 watts per square foot was assumed as the basis for sizing feeders; switchgear was figured for a 100 percent demand factor, and



BUSDUCT FEEDERS are carried upwards to top floor, through service closets containing panelboards for local control of power and lighting. Voltage drop from switchgear to top of most remote riser is less than two volts.

provisions were included for additional future capacity and the possible erection of extra floors above the existing structure.

Main switchgear, served by three 4000-amp take-offs from 120/208-volt 3-phase 4-wire 60-cycle utility network, is the largest switchgear installation to date in any San Francisco commercial building. Another "greatest" is the 3900-kva load (2435 for lighting; 1465 for power), for this is the largest demand to be placed on the downtown network in more than a decade. Switchgear is metal-enclosed, with removable air circuit breakers equipped with circuit-interrupting disconnecting devices, current transformers, meters and test blocks. Breakers are mounted on insulated pantograph steel frames equipped with roller bearing wheels for moving the equipment in and out. Individual breaker compartments are equipped



MAIN SWITCHGEAR, largest in the city, has three 4000-amp service feeders; is equipped with induction-type overcurrent relays; has ample capacity for future additions, and includes meters for checking load balance instantaneously.

SCHEMATIC WIRING DIAGRAM indicates breaker position, inclusion of step-up transformers for 440-volt power, and automatic transfer provisions for battery-served emergency lighting system.

with primary and secondary contacts, with induction relay interlocks provided for automatically tripping breakers if movable breakers are not in position. Phase loading of the three service feeders is readily checked by a common ammeter. And metering is accomplished by paralleling the secondaries of the current transformers and using a common watt-hour meter.

Two of the three 4000-amp low-reactance busway services carry the load of the 2666 lighting circuits in the building. This total includes 24 emergency circuits for stairwells, general sales areas, restrooms and certain service areas. These circuits are doubly served by a 60-cell 120-volt dc Exide battery, capable of operating 23,000 incandescent lamps for an hour period. Cut-over to the emergency system is instantaneous in the event of an ac failure, through the operation of a 100-amp automatic transfer switch. Battery strength is maintained by a dry-disc selenium rectifier trickle charger.

The third 4000-amp service directly takes care of all 208-volt power requirements and, through a bank of three delta-delta 200-kva transformers, all 440-volt motor loads. Two-voltage power was desirable due to the fact that much of the large equipment salvaged from the original building was wired for 480 volts 3-phase. Converting these motors (for eleven 50-hp elevators, four 50-hp air conditioning units, garage and kitchen exhaust fans, sewage pumps and ejectors, sprinkler

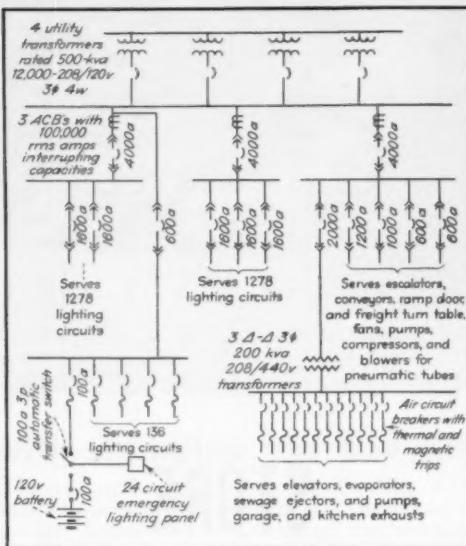
pumping system, etc.) was economically inadvisable, so the present 208-volt incoming power was stepped up to serve these units. However, all new motors are wired for 208-volt operation. This category includes two 125-hp compressors, 14 escalators ranging from 30-hp to 12-hp capacities, conveyors, loading ramp doors and turntables, pumps, fans, and blowers for the pneumatic tube system.

Distribution between main switchgear and load-center panelboards is predominantly by ventilated low re-

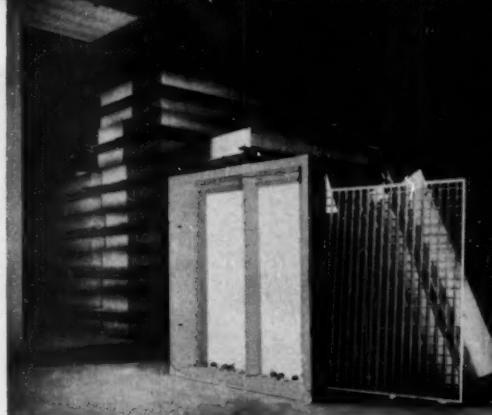
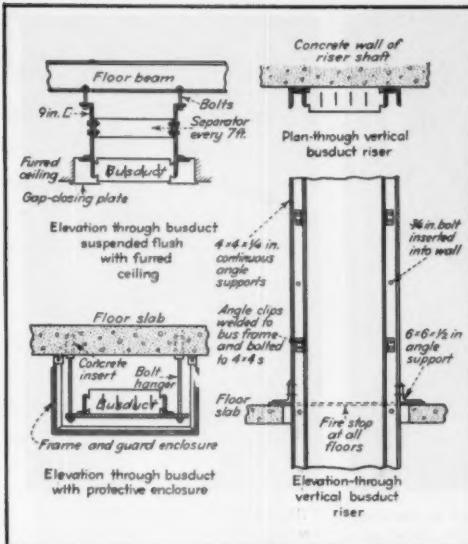
actance enclosed busway, 4-wire for lighting, 3-wire for power.

Busways are carried along the basement ceiling to riser points by several suspension methods.

One method is used in service areas where ceilings are unfurred and protection is desired against possible sprinkler spray or mechanical damage. In these areas the duct is enclosed by 16-gauge solid steel guards. Another method is used where ceilings are furred and duct is to be hidden, yet readily accessible, such as in the base-



MERCHANDISE on first floor counters is illuminated to intensity of 30 foot-candles by 6-lamp eggcrate-louvered fluorescent squares recessed into the acoustical ceiling on 2-way 11½-foot centers.



DETAILS OF FLUORESCENT SQUARES show positioning of lamp sockets and starters, construction of eggcrate grids, and provisions for mounting the fixtures.

METHODS OF DUCT SUPPORT varied with feeder location and position. Horizontal runs are openly suspended, enclosed flush with finished ceilings, or protected by steel guard plates. Vertical feeders are clipped to continuous angles for support, with fire guards enclosing risers at each floor level.

ment elevator corridor. Here the duct is supported flush with the finished ceiling by continuous steel channels bolted to ceiling beams. Continuous 20-gauge steel plates bridge the gaps between duct and ceiling edges.

Four of the busway feeders are carried upwards to the top floor to supply lighting panelboards located at the various levels. Frames are supported every 4 feet by clips welded to continuous 4×4 -inch angles that extend vertically to the top of the riser. These angles are, in turn, supported at each

floor level by 6×6 -inch supporting brackets and, in addition, by $\frac{3}{4}$ -inch bolts inserted every 42-inches into the concrete walls of the riser shafts. Expansion joints are located at the 4th floor, approximately half way up the risers. Fire stops of 16-gauge steel are fitted snugly around the busduct frames at all floor levels. Lighting risers are rated at 1600- and 2000-amps each.

Panelboards (conveniently located on each floor in electrical service closets enclosing the busway risers) are equipped with air breakers. Boards

are flush-mounted dead-front steel-cubicle construction with over-sized wiring gutters and breaker facilities for all circuits. Maximum voltage drop from service entrance to the most remote panelboard is less than 2 volts.

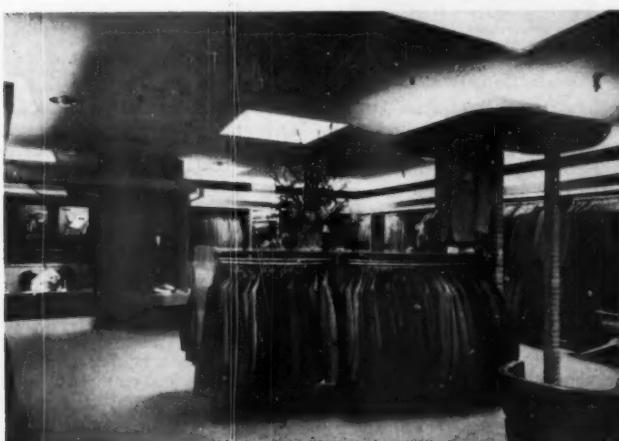
In the new structure, branch wiring to floor receptacles for counter lighting, electrical cash registers, water coolers and other portable equipment, is via underfloor ducts in deck slabs. Precast floor taps are located on 2-foot centers. In the old building, existing conduit-carried floor wiring was reused, picked up and tied to new panelboards. Overhead wiring to lighting fixtures is via EMT, run through the space above the hung ceilings. Wiring is generally Type R, with RH used in hot locations and RL installed in areas subject to moisture. Minimum wire sizes are 12 gauge for receptacles and lighting; 14 gauge for motor control.

Grounding of switchgear, busduct frames, panelboards, lighting fixtures, conduit, motors and control equipment is in accordance with NEC standards.

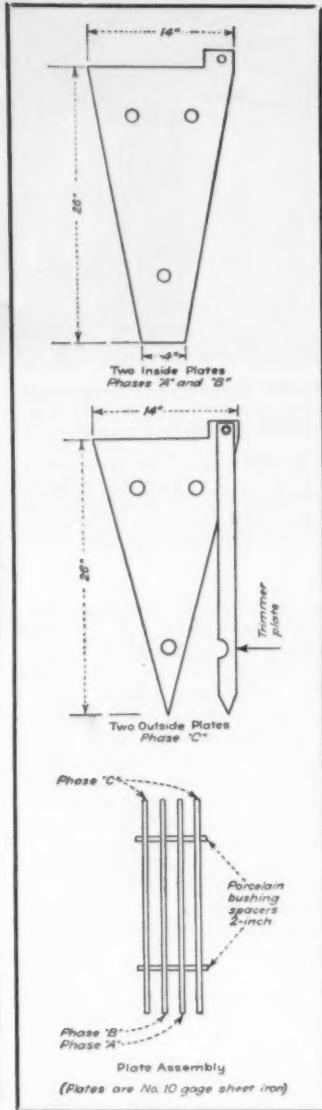
Illumination

Illumination levels are 30 footcandles in first floor sales areas, 8th floor offices and 9th floor cafeteria and stockrooms; 20 footcandles in basement sales areas and on floors 2 through 5; and 12 ft-c on the 6th and 7th floors. In addition to in-built lighting, the 6th and 7th floors also utilize table and floor lamps, bringing intensity to 20 ft-c.

(Continued on page 178)



MEN'S SHOP lighting plan combines recessed 4-lamp fluorescent ceiling fixtures, coves around columns and wall racks, swiveling spot- and flood-lamps, separate in-built wall-case overhead strips, and display-counter edge lighting.



DESIGN DETAILS of electrode plates for three-phase water rheostat.

ONE method of providing an artificial load on motors and generators for test purposes is to use a liquid rheostat. This is especially true where large amounts of power must be dissipated. Normal motor shop practice is to place an electrode in a tank or barrel of water—one tank for each phase. Testing three-phase equipment requires a three-tank rheostat.

At the Roy A. Berentz Company, electrical equipment repair shop in



FOUR-PLATE ASSEMBLY of electrode is shown in this end view. Note porcelain bushing spacers. Two inner plates are Phases A and B. Two outer plates constitute Phase C with load equalizing trimmer arms.



THREE-PHASE ELECTRODE being lowered into drum of water to provide an artificial load on motor test. Note triangular shape of plates. Trimmer plate in foreground is adjustable to equalize load on all phases.

THREE-PHASE WATER RHEOSTAT

Single-tank water rheostat provides loading for motor and generator shop testing.

Houston, Texas, three-phase loading is accomplished with a single-tank rheostat. The unit was designed and constructed by L. B. Davenport, Berentz shop superintendent, as a result of his experiences during the War in an aircraft engine plant.

The space-saving rheostat consists of four triangular-shaped No. 10 gauge sheet iron plates separated by 2-inch porcelain bushings. The two inside plates (Phase A and Phase B) are 14-inches wide at the top, four inches at the bottom and 26-inches long. The two outside triangular plates are Phase C Electrodes and contain a "trimmer" plate which can be adjusted to equalize the load on all three phases. To increase the load on Phase C, the trimmer plate is moved outward

to create more plate surface. Moving the trimmer in reduces the overall surface of the electrode and decreases the load on that phase plate.

The complete electrode assembly is mounted to a counter-weighted cable; can be lowered into a 55-gallon oil drum filled with continuously circulating water to dissipate the heat. Counter-weight balance is such that the electrodes will remain at whatever position they are placed. By having the electrode plates tapered in triangular fashion, the load on the test motor will be directly proportional to the mechanical travel of the assembly as it is lowered into the water. Motors and generators up to 75 kva., 3-phase, 440-volt ratings can be tested on the device.

Common Cause

Under mobilization, controls, and new responsibilities the electrical construction industry stands ready and confident. The electrical contractor's role in the fast-changing scene is voiced by Edw. Vanderlinde, President of the National Electrical Contractors Association in a pre-convention interview by W.T. Stuart.



... his house should be in order ...

W. T. Stuart: Behind the headlines we are all going through a period of adaptation to a new economic and business environment. Could you outline, Mr. Vanderlinde, how the electrical contractor ought to be guiding his course right now?

E. Vanderlinde: That's a large order. At the risk of over simplifying, I'll line up, briefly, some areas of importance ...

1. His house should be in order; in finance, staff, manpower, plant, and equipment.
2. His trade relations should be confident and efficient; with suppliers, with labor, yes, even with his competitors.
3. He should keep informed, not only on current activities in the Capitol, but on his industry.
4. He should be a source of help and counsel to his customers, willing and able to guide them in their adjustments to new requirements.

W. T. S.: What kind of help and counsel to customers do you have in mind on your fourth point?

E. V.: I could answer that best by citing a couple of examples. Every contractor has in his community a factory or a

warehouse or an office building that is in bad shape electrically. Inadequate lighting, overloaded feeders, antique controls and a general state of debility. Some, maybe all, of these places will be called upon to serve in one way or another in a national emergency. Will electrical obsolescence cripple their effective use?

Right now and for an uncertain number of months ahead, there are manpower, materials, supervision, and engineering skills available to modernize these places. It would be a sound investment at any time, it may be vital to the productive resources of a war economy.



... get our customer's electrical system in shape ...

The owner and operator of these places don't know they are as bad off as they are. Only an expert can detect the imminent overload, the inevitable breakdown ahead. Here I think our industry has its No. 1 immediate responsibility — to use every means of persuasion we can muster to get our customer's electrical system in shape for probable demands.

W. T. S.: Do you think the contractor ought to initiate such recommendations, at this time, in other words should he go out and sell?

E. V.: By all means. How do we know that the customer knows enough about his electrical system to take needed ac-

tion ahead of time. It is far better for a contractor to go out and sell an industrial plant on modernization now than to wait until overloads and breakdowns stop his conversion where men and materials are scarce.

W. T. S.: What particular responsibilities do you feel electrical contractors should assume with respect to Washington mobilization plans?

E. V.: There is not much the individual contractor can do at this stage. Through NECA, however, we have committees which are competent and ready to counsel with government agencies and render every assistance we can. The best thing the individual contractor can do, in my opinion, right now, is to keep in close touch with association activities and stand ready to serve on committees when he is called. Our national headquarters is already gathering data for the information of Government bodies.

W. T. S.: How about local activities?

E. V.: The NECA Chapter is the logical focus for local industry activities. We have been urging more active committee work locally to carry out the programs of the National Headquarters.

(Continued on page 177)



... training is necessary to keep pace today.

1. RIGID CONDUIT, BRANCH CIRCUITS

1a. Rigid Conduit

Conduit in reinforced concrete slab	1/2 in.	4.00	per C ft.
Straight runs	3/4 in.	4.60	per C ft.
Minimum bends	1 in.	6.30	per C ft.
Deep boxes	ceiling wall	35 65	per C per C
Shallow boxes with offsets	ceiling wall	40 70	per C per C

1b. Rigid Conduit

Conduit in fill in tile or pan type floor construction	1/2 in. 3/4 in.	4.10 4.70	per C ft. per C ft.
Two ells per run	1 in.	6.40	per C ft.
Outlets	ceiling wall	40 70	per C per C

1c. Rigid Conduit

Conduit in suspended ceiling	1/2 in.	4.00	per C ft.
Straight runs with minimum bends	3/4 in.	4.60	per C ft.
	1 in.	6.30	per C ft.
Outlets	ceiling	45	per C
	wall	70	per C

1d. Rigid Conduit

Conduit exposed on accessible surface, on hangers, or on beam clamps	1/2 in. 3/4 in. 1 in.	5.00 5.80 7.50	per C ft. per C ft. per C ft.
Outlet boxes	ceiling wall	45 45	per C per C
Threaded fittings	ceiling wall	45 45	per C per C
Threadless fittings	ceiling wall	35 35	per C per C

NOTES:

- a. No fastenings or hangers included in 1d units.
- b. Units may be used for exposed work on wood without additional fastening time.
- c. For exposed work on concrete, brick, tile or steel, add labor hours for installation of fastenings, hangers, clamps, etc.
- d. Add for high work.

10 foot ceiling	Net +10%
11-15 foot ceiling	+25%
16-20 foot ceiling	

For higher work add a lump sum for each area based on means available for reaching the "job face."

2. ELECTRICAL METALLIC TUBING, BRANCH CIRCUIT

24 F.M.I.

In reinforced concrete slab	1/2 in.	2.80	per C ft.
Straight runs	3/4 in.	3.00	per C ft.
Minimum bends	1 in.	4.10	per C ft.
Deep boxes	ceiling wall	35 65	per C per C
Shallow boxes	ceiling wall	40 70	per C per C

9b. E. M. I.

In concrete fill in tile or pan type floor construction Two ells per run	1/2 in. 3/4 in. 1 in.	3.00 3.20 4.30	per C ft. per C ft. per C ft.
Outlets	ceiling wall	40 70	per C per C

96 E M T

In suspended ceiling Straight runs with minimum bends	1/2 in. 3/4 in. 1 in.	3.00 3.20 4.30	per C ft. per C ft. per C ft.
Outlets	ceiling wall	45 70	per C per C

3d EMT

Exposed on accessible surface, on hangers, or on beam clamps	1/2 in.	4.80	per C ft.
	3/4 in.	5.00	per C ft.
	1 in.	5.10	per C ft.
 Outlet boxes			
	ceiling	35	per C
	wall	35	per C
 Fittings			
	ceiling	35	per C
	wall	35	per C

NOTES:

- a. No fastenings or hangers included in 2d units.
- b. Units may be used for exposed work on wood without additional fastening time.
- c. For exposed work on concrete, brick, tile or steel, add labor hours for installation of fastenings, hangers, clamps, etc.
- d. Add for high work.

10 foot ceiling	Net
11-15 foot ceiling	$+10\%$
16-20 foot ceiling	$+25\%$

 For higher work add a lump sum for each area based on means available for reaching the "job face."

How to Estimate Electrical Work—9

- Unit data for Branch Circuit Roughing
- Unit data for Signal and Special Systems
- Unit data for Feeders

LABOR unit data are the standards or bench marks which the estimator uses to approximate probable labor costs on a particular project. They are essential and often very precise tools in the hands of a skilled estimator.

No set of average data can substitute, however, for competent and experienced estimating judgment. No set of data can be used "raw". The operators described in the 7th article in this series must be employed. And, of course, no set of data should ever be used for actual bidding without a thorough comparison with actual past performance or with units of known accuracy as described in the 8th article in this series.

The following tables of labor units are based upon average performance under the average conditions of management, tooling and material handling found in organizations employing 10 to 20 men, or somewhat larger than the average electrical contractor. The units are based upon average expected performance of 1950. Assured job

conditions are good (See operators, page 39, August E. C. & M.).

Units include normal supervision and job manning; the labor hours usually charged to the job as direct labor. Management, engineering, supervision, drawings, cartage, off-the-site material handling and other items which constitute overhead or job expense are not included.

The first group of unit data tables includes branch circuit roughing, signal and special system roughing, and feeder conduit runs for rigid conduit and electrical metallic tubing.

For branch circuits and special systems, cuts, elbows and bends are included in the conduit and outlet units. For feeders, cuts, elbows and bends must be added.

For exposed work, no fastenings are included. The units may be used without additional fastening labor for wood construction. For other types of work, however, the number and types of fastenings should be taken off and added as a separate item.

3. RIGID CONDUIT ROUGHING FOR SIGNAL WIRING AND SPECIAL SYSTEMS

3a. Rigid Conduit

			man hours
Slab	1/2 in.	3.50	per C ft.
	3/4 in.	4.10	per C ft.
	1 in.	5.80	per C ft.
Outlet		80	per C
3b. Rigid Conduit			
Tile or pan	1/2 in.	3.60	per C ft.
	3/4 in.	4.20	per C ft.
	1 in.	6.00	per C ft.
Outlet		85	per C

3c. Rigid Conduit

		man hours
Suspended ceiling	1/2 in.	3.50
	3/4 in.	4.10
	1 in.	5.80
Outlet		85
3d. Rigid Conduit	per C ft.	per C
	per C ft.	per C
	per C ft.	per C
Exposed	1/2 in.	5.00
	3/4 in.	5.80
	1 in.	7.50
Outlet		70

NOTES: a. See notes under 1d. b. Outlets are 52151 boxes. For larger or special outlet add 30.00 per C.

4. E. M. T. ROUGHING FOR SIGNAL WIRING AND SPECIAL SYSTEMS

4a. E. M. T.		man hours		
Slab	1/2 in.	2.30	per C ft.	
	3/4 in.	2.50	per C ft.	
	1 in.	3.70	per C ft.	
Outlet		80	per C	
4b. E. M. T.				
Tile or pan	1/2 in.	2.50	per C ft.	
	3/4 in.	2.70	per C ft.	
	1 in.	3.90	per C ft.	
Outlet		85	per C	
4c. E. M. T.				
Suspended ceiling	1/2 in.	2.50	per C ft.	
	3/4 in.	2.70	per C ft.	
	1 in.	3.90	per C ft.	
Outlet		85	per C	
4d. E. M. T.				
Exposed	1/2 in.	4.80	per C ft.	
	3/4 in.	5.00	per C ft.	
	1 in.	5.10	per C ft.	
Outlet		70	per C	

NOTES: a. See notes under 2 d.
b. Outlets are 52151 boxes. For larger or special outlets add 30.00 per C.

5. RIGID CONDUIT FOR FEEDERS

5a. Conduit, Manhours per C ft.			
	Concealed	Exposed	On Hangers
1/2 in.	4.60	5.00	5.20
3/4 in.	5.00	5.80	6.00
1 in.	6.80	7.50	7.70
1 1/4 in.	9.10	9.90	9.30
1 1/2 in.	10.80	11.00	11.00
2 in.	.....	12.30	12.30
2 1/2 in.	.....	16.20	16.20
3 in.	.....	20.00	20.00
3 1/2 in.	.....	24.00	24.00
4 in.	.....	29.00	29.00

5a. (Continued)		Manhours per C		
		Cuts	Elbows	Bends
1/2-3/4 in.	7.50	.....	10.00	
1 in.	10.80	21.00	11.00	
1 1/4 in.	13.30	30.00	27.00	
1 1/2 in.	18.40	42.00	40.00	
2 in.	26.70	65.00	60.00	
2 1/2 in.	29.10	78.00	70.00	
3 in.	47.00	103.00	90.00	
3 1/2 in.	58.00	130.00	110.00	
4 in.	70.00	164.00	130.00	

NOTES: a. Cuts are based upon hand threading. For power driven machine threading deduct 25 percent from units above 1 1/4 inch.
b. Bends are based upon the use of pipe bending machines on sizes 1 in. and above.
c. No fastenings or hangers are included in 5-a units.
d. Add for high work.

10 feet	Net
10-15 feet	+10%
16-20 feet	+25%

For higher work add a lump sum based on means available for reaching the "job face."

6. E. M. T. FOR FEEDERS

6a. E. M. T., Manhours per C ft.

	Concealed	Exposed
1/2 in.	4.50	4.60
3/4 in.	4.70	4.80
1 in.	5.70	5.80
1 1/4 in.	6.00	6.20
1 1/2 in.	7.20	7.40

Manhours per C			
	Cuts	Elbows	Bends
1/2 in.	6.00	.....	8.00
3/4 in.	6.00	.....	8.00
in.	8.00	8.20	9.00
1 1/4 in.	10.40	11.00	22.00
1 1/2 in.	12.00	12.60	35.00

NOTES: a. No fastenings or hangers are included in 6a units.
b. See note d under 5 a for high work.

LIGHTING - 1950

A PROGRESS REPORT

By The Editors of
ELECTRICAL CONSTRUCTION and MAINTENANCE



LIHTING in 1950 shows progress in design, adaptation and function. Planning, layout, and equipment selection to provide predetermined results is making great strides, especially in commercial and school lighting. But market-wise, opportunities for modern lighting application are still largely undeveloped. Further exploration of the possibilities for greater industry teamwork in market development and sales promotion is needed. In the following editorial feature section, the editors present a progress report through market analysis and typical installation case studies.

INDIANAPOLIS LIGHTING

APPROXIMATELY 85 percent of the lighting in the average American city is inadequate, based on Illuminating Engineering Society standards. This fact developed from a comprehensive lighting market survey made recently in Indianapolis, Indiana.

This survey was sponsored by the Industrial and Commercial Lighting Equipment Section of the National Electrical Manufacturers Association. Indianapolis was chosen as the test city for this survey, and for a subsequent Planned Lighting promotion campaign on the premise that it is a typical American city.

Objectives of the survey were to determine the lighting potentialities in the test area, the accomplishments of the lighting industry in reaching this market, and to obtain information relating to existing lighting levels, types of lighting units and systems in use and purchased during a base period, customer attitudes on buying or not buying new lighting, professional consultation by lighting customers before purchase, and various other similar information and data which might be useful in making an appraisal of the potential lighting market in the test area. These data were also used by the sponsor for establishing a base or bogey for lighting equipment sales during a test promotional campaign period. A. J. Wood & Co., a Philadel-

phia, Pa., market research agency, conducted the physical survey, and F. W. Mansfield, Director of Sales Research for Sylvania Electric Products, Inc., served as consultant to NEMA and analyzed and abstracted the findings of the survey. The Electric League of Indianapolis, Inc., conducted the promotional sales activity, supported by the Indianapolis Power and Light Company, and by the various local distributors, lighting equipment manufacturers representatives and electrical contractors.

Report on the promotional activity is not yet available, hence is not covered in this summary of the survey.

This report covers some of the more pertinent data obtained through the survey. These data, and information which can be derived therefrom, can be used by any segment of the lighting industry to estimate local lighting markets, and to promote the sale of more and better lighting in these markets. These data have been used here to project national relighting market potentials, and as a matter of record for the lighting industry, since reliable statistics in this industry have, in general, been very meager.

For purposes of simplification, all data are reported by type of establishment, which have been divided into five groups, as shown in Table I. Analysis of these data reveals many

interesting facts, as shown by the Tables, and by the following comments.

An analysis of existing lighting in the 14,020 establishments covered by the survey is shown in Table II, with the establishments broken down into their five classification groups. These data reveal that of the 38.6 luminaires total per establishment average, 24.6 luminaires are incandescent while 14.0 luminaires are fluorescent. They also show that the average square foot area per luminaire ranges from 102 in retail stores to 312 in small industrial plants for a weighted average of 164 square feet per luminaire in all establishments. These conditions existed at the time the survey was made.

Less than 20 percent of the lighting fixtures in use in Indianapolis have been installed since the end of World War II, the survey shows. This indicates that approximately 80 percent of the lighting equipment in use is four or more years old. Since very little lighting equipment was sold or installed during the War, it is reasonable to assume that about three-fourths of the lighting equipment in use today is eight or more years old, and far along the road to obsolescence. About 75 percent of the lighting equipment sold in the postwar period has been fluorescent, based on number of units, according to the survey. The balance has been incandescent and mercury

TABLE I—KEY TO TABLES
(Identifying Types of Establishments*)

A	B	C	D	E
				
RETAIL STORES	RECREATION	OFFICES	INDUSTRIAL	SCHOOLS
Drug Stores Grocery Stores Bakeries Department Stores Hardware Stores Furniture Stores Appliance Stores Specialty Shops Automobile Salesrooms Service Shops Other Retail Outlets	Theatres Lodge and Assembly Halls Restaurants Hotels Hospitals Taverns Sandwich Shops Ice Cream Parlors Pool Rooms Churches	Banks General Offices Professional Offices Office Buildings	Smaller Industries* Warehouses Coal Yards Greenhouses	Public Private Parochial

* The Indianapolis Lighting Market Survey did not include approximately 100 large users of lighting in Marion County, Indiana.

MARKET SURVEY

TABLE II—ANALYSIS OF EXISTING LIGHTING IN ESTABLISHMENTS IN INDIANAPOLIS

	TYPE OF ESTABLISHMENT					Total
	A	B	C	D	E	
No. of Establishments	6,902	2,428	2,427	2,053	210	14,020
Total Area all Establishments (000 sq. ft.)	18,600	24,600	8,200	34,600	3,200	89,200
Area per Establishment (sq. ft.)	2,700	10,200	3,340	16,820	15,380	6,350*
KWH per Establishment (Ave. June 1949)	878	3,935	1,840	4,274	679	2,068*
KWH per 1000 sq. ft. (Ave. June 1949)	326	388	545	254	645	325*
Luminaires per Establishment (Ave.)						
Incandescent	10.5	58.0	15.1	35.5	106.0	24.6*
Fluorescent	16.1	8.3	8.6	18.9	22.9	14.0*
Total	26.6	66.3	23.7	54.4	128.9	38.6*
Luminaires per 1000 sq. ft. (Ave.)	9.8	6.5	7.1	3.2	8.4	6.1*
Area per Luminaire (sq. ft. average)	102	154	141	312	119	164*
Total Luminaires, all Establishments	183,500	161,000	57,500	112,000	27,000	541,000

* Average for all Establishments

TABLE III—TOTAL NUMBER LUMINAIRES INSTALLED IN INDIANAPOLIS ESTABLISHMENTS

	TYPE OF ESTABLISHMENT					Total*
	A	B	C	D	E	
Number of Establishments	6,902	2,428	2,427	2,053	210	14,020
Luminaires per Establishment						
a. Incandescent	10.5	58.0	15.1	35.5	106.0	24.6
b. Fluorescent	16.1	8.3	8.6	18.9	22.9	14.0
c. Total	26.6	66.3	23.7	54.4	128.9	38.6
Total Luminaires Installed						
a. Incandescent	72,500	141,000	36,500	73,000	22,000	345,000
b. Fluorescent	111,000	20,000	21,000	39,000	5,000	196,000
c. Total	183,500	161,000	57,500	112,000	27,000	541,000
Ratio to Total Luminaires (Percent)						
a. Incandescent	39.5	87.5	63.7	65.3	82.2	63.7
b. Fluorescent	60.5	12.5	36.3	34.7	17.8	36.3
c. Total	100.0	100.0	100.0	100.0	100.0	100.0

* Totals and weighted averages.

TABLE IV
EXISTING LIGHTING LEVELS IN INDIANAPOLIS ESTABLISHMENTS

Footcandle Range						Total*
	A	B	C	D	E	
1 to 5	10	25	3	14	12	12
6 to 10	20	22	22	23	21	21
11 to 20	27	23	34	23	28	27
21 to 30	17	17	25	11	13	17
31 to 45	13	10	7	15	17	12
46 and over	13	3	9	14	9	11
Total	100	100	100	100	100	100

* Weighted averages.

TABLE V—PURPOSE OF NEW FIXTURE INSTALLATION

Purpose	TYPE OF ESTABLISHMENT (Figures represent percentages)					Total*
	A	B	C	D	E	
Replacement of old fixtures	63	62	60	43	75	59
Additional fixtures	14	9	7	19	25	13
Original installation	32	32	33	49	—	35
Total**	109	103	100	111	100	107

* Weighted averages.

** Total exceeds 100 percent because of multiple answers.

TABLE VI
WHERE CUSTOMERS PURCHASED NEW LIGHTING EQUIPMENT

From:	TYPE OF ESTABLISHMENT (Figures represent percentages)					Total*
	A	B	C	D	E	
Electrical Contractor	47	48	43	37	25	44
General Contractor	8	7	10	6	25	8
Outside Electrician	16	19	5	9	25	14
Electrical Wholesaler	19	15	24	33	25	23
Fixture Manufacturer	2	—	10	8	—	3
Other (a)	8	11	14	12	—	10
Total**	100	100	106	100	100	102

* Weighted averages.

** Totals exceed 100% because of multiple answers.

(a) Such as: Department or Electric Supply Store.

TABLE VII—WHY CUSTOMERS PLAN TO INSTALL NEW LIGHTING*

Reason	TYPE OF ESTABLISHMENT (Figures represent Percentages)					Total**
	A	B	C	D	E	
More Economical, Reduce Cost	4	22	—	—	—	5
Remodeling, Expanding	12	11	17	20	50	17
Better Appearance	42	56	25	—	—	31
Improved (Better) Lighting	42	33	42	40	25	39
Improved Working Conditions	17	11	17	30	—	19
Present Lighting Unsatisfactory	4	—	8	10	50	8
Improves Display	4	—	—	—	—	2
Less Heat	4	—	—	—	—	2
New Building, Moving	4	—	—	—	—	2
More Efficiency	—	—	8	—	—	2
Other	4	—	—	10	—	3
Total***	137	133	117	110	125	130

* As reported by establishments who stated they planned to install new lighting during the twelve-month period following the survey.

** Weighted averages.

*** Totals exceed 100% because of multiple answers.

vapor. (The survey does not include certain miscellaneous types of lighting such as lighting for decorative or advertising purposes, signs, etc., which it is estimated amounts to about one-tenth of one percent).

Existing Intensities

Table IV shows a breakdown of existing lighting levels in the five groups of establishments. Intensities of 46 footcandles or more exist in only eleven percent of the total number of establishments, while in these same class areas one-third of the establishments had less than ten footcandles. Sixty percent had less than 20 footcandles. Certainly the market for relighting has barely been scratched.

Table V explains why new lighting fixtures were purchased by Indianapolis establishments between January 1, 1948 and June 30, 1949. The "replacement of old fixtures" was the reason given by 59 percent, while "additional fixtures" accounted for 13 percent and "original installation" accounted for 33 percent. This indicates that about one-third of the lighting installations were for new construction jobs, while two-thirds were for relighting projects. The number of "original installation" jobs are, of course, dependent on new construction activity, while the number and size of relighting projects is dependent on sales effort and promotional activity.

Over half of the Indianapolis establishments purchased their lighting equipment from electrical contractors and outside electricians, as revealed by the survey and shown in Table VI. About one-fourth purchased from electrical wholesalers direct. Increased lighting promotional activity by contractors, and more cooperation with contractors by the wholesalers, should easily influence customers to purchase a much higher percentage of their lighting requirements from electrical contractors.

Table X reveals another interesting fact. It shows that one-fourth of the prospective purchasers of lighting received no professional advice before buying. However, on the average, 38 percent of the customers in Indianapolis consulted the electrical contractor for advice and lighting recommendations before buying, which was considerably more than consulted any other one source. Professional consultation by prospective customers of lighting will, however, vary considerably from one community to another, depending on local promotional activity by the various professional consultants

TABLE VIII—SINGLE MOST IMPORTANT REASON FOR PLANNING NEW LIGHTING*

or segments of the lighting industry. Table VII outlines why customers buy new lighting. It shows that more customers buy new lighting to provide "improved (better) lighting" than for any other reason. Better appearance and improved working conditions were other reasons given by a high percentage of the prospective customers.

Excuses for not buying new lighting are shown in Table XI. Only five percent of prospective new lighting customers gave as their excuse "waiting for lower cost fixtures". Nearly 60 percent said their present lighting was satisfactory.

What does the lighting customer expect of a new lighting system? Answers to this question are given in Table IX. The one benefit which most customers expected was "more (better) illumination". Retail stores and places of recreation or congregation placed "better appearance of establishment" as the second most desired benefit, while offices and industrial plants placed "improved working conditions" second.

The Indianapolis survey showed a definite need for a continuing program of education to the public on the benefits and advantages of better lighting. Nearly 60 percent of those who are not planning to improve their lighting said they were satisfied with their present installations. Yet, as shown by Table IV, 60 percent of the establishments in Indianapolis had less than 20 foot-candles of illumination. It is obvious that the entire lighting industry must cooperate in an educational program to the public, at the local level, to make people dissatisfied with their below standard lighting.

How To Use Data

Lighting salesmen can develop new and powerful sales presentations for specific customers through study of Tables VII, VIII, IX, and XI, and the use of reasons or benefits given in these Tables which apply to his specific customers. Data given in these Tables can also furnish guidance for lighting promotion by mail or personal calls.

Use of data and information resulting from the Indianapolis survey can also be made to determine the size of local lighting market potentials for any community, and for any of the five specific groups of establishments. New appraisals of local lighting markets will serve as an incentive to organize for selling these markets, for setting up new and higher sales quotas on a sound basis, and for selling better lighting installations.

Reason	TYPE OF ESTABLISHMENT (Figures represent percentages)					
	A	B	C	D	E	Total**
Better Appearance	57	100	—	—	—	44
Improved (Better) Lighting	29	—	—	50	100	25
Improved Working Conditions	—	—	100	—	—	19
Improved Display	14	—	—	50	—	12
Total	100	100	100	100	100	100

* As reported by establishments who stated they planned to install new lighting during the twelve-month period following the survey.

** Weighted averages.

TABLE IX—WHAT CUSTOMERS EXPECT FROM NEW LIGHTING

Benefits	TYPE OF ESTABLISHMENT (Figures represent percentages)					
	A	B	C	D	E	Total*
Better Appearance of Establishment	58	75	41	17	—	50
More Sales	11	6	—	—	—	6
Better Display of Merchandise	9	3	—	—	—	5
Improved Working Conditions	35	24	59	67	25	42
More (Better) Illumination	72	70	67	73	100	73
Other (a)	14	9	15	23**	—	14
Total***	199	187	182	180	195	190

* Weighted averages.

** Primarily "employee good-will."

*** Totals exceed 100% because of multiple answers.

(a) Such as: less heat, more efficient, reduce cost, safety

TABLE X—CUSTOMER CONSULTATION BEFORE PURCHASING NEW LIGHTING

Consultant	TYPE OF ESTABLISHMENT (Figures represent percentages)					
	A	B	C	D	E	Total*
No One	36	—	—	35	—	26
Architect	2	9	—	—	25	3
Electrical Contractor	31	50	55	37	50	38
General Contractor	4	14	7	8	25	7
Lighting Engineer	5	—	7	—	25	4
Interior Decorator	—	—	—	—	—	—
Fixture Manufacturer	2	—	—	3	—	2
Electrical Wholesaler	10	5	19	3	25	9
Electric Utility	2	—	—	3	25	2
Friend or Acquaintance	10	32	—	8	—	10
Other (a)	9	5	12	5	—	8
Total**	111	115	100	102	175	109

* Weighted averages.

** Total exceeds 100% because of multiple answers.

(a) Such as: Department Store, Electric Supply Store, Building Electrician.

**TABLE XI
WHY CUSTOMERS ARE NOT PLANNING ON NEW LIGHTING***

Reason	TYPE OF ESTABLISHMENT (Figures represent percentages)					
	A	B	C	D	E	Total**
Present Lighting Satisfactory	56	55	57	52	67	58
Recently Installed New Lighting	15	18	26	21	33	18
Waiting for Lower Cost Fixtures	7	6	3	7	—	5
Waiting for Redecoration or Remodeling	5	4	2	5	—	4
Other (a)	17	17	12	16	33	16
Total***	100	100	100	101	133	101

* As reported by establishments who stated they did not plan to install new lighting during the twelve-month period following the survey.

** Weighted averages.

*** Totals exceed 100% because of multiple answers.

(a) Such as: Rental Only, Moving, No Funds, Etc.

The Lighting Market

SINCE the introduction of the fluorescent lamp to the public twelve years ago, artificial lighting has become big business. Just how big has been pretty much guess work. One fairly reliable estimate placed the 1948 lighting market at \$500 million, covering all types of lighting. This estimate placed commercial and industrial lighting that year at approximately \$200 million, which the Census of Manufactures, 1947, substantiates as being fairly accurate.

The Indianapolis Lighting Market Survey, summarized briefly on the preceding four pages, provides new and reasonably accurate data on which to base lighting market statistics and potentials. Two estimates of the annual lighting market in the United States are given in Tables XII and XIII below, based on data from the Indianapolis survey and other known factors.

In Table XII the estimate is based on average purchases *per establishment*, in Indianapolis, and projected to a national total based on the total number

of establishments in the U. S., assuming that the Indianapolis average per establishment will prevail nationally. This estimate results in a \$362 million lighting market annually for commercial and industrial lighting only.

A similar estimate is shown in Table XIII, which is based on average purchases *per 1000 population* in Indianapolis, and projected to a national total based on the total U. S. population. This estimate results in a national annual lighting market total of \$408,750,000. These two estimates show a variation of only 11.5 percent.

Similar estimates can be made for any community, and should provide a fairly accurate estimate of the annual lighting market in such community.

It should be noted, however, that the average purchases *per establishment*, or *per 1000 population*, as revealed by the Indianapolis survey, were for a base period covering 1948 and the first six months of 1949. Under normal growth the figures should be slightly higher for estimates of today's market.

The Indianapolis survey was also used as a basis for estimating the "Relighting Market Potential in U. S." shown in Table XIV. Key for this estimate was the *average area per establishment and establishments with less than 30 footcandles* in Indianapolis. The number of luminaires required to light 1000 square feet to an intensity of 30 footcandles was estimated for the various types of establishments, and priced conservatively. These costs were then applied to the total area of the establishments lighted to less than 30 footcandles.

With the United States now engaged in a partial war economy, there will in all probability be some cut-back in new construction, especially in the commercial and residential fields. Should this occur, the relighting market will increase in importance, short of an all-out war economy. The size of the relighting market potential thus takes on new significance.

Column D in Table XIV represents industrial plants. In case of an all-out war, the importance of relighting these

TABLE XII—ANNUAL LIGHTING MARKET IN UNITED STATES

(Based on Average Purchases per Establishment as Revealed by Indianapolis Lighting Market Survey)	
Number of Establishments Covered by Survey.....	14,020
Lighting Equipment Sales by Indianapolis Electrical Wholesalers (Base Period of Jan. 1, 1948 to June 30, 1949)*.....	\$1,704,115
Annual Lighting Equipment Sales in Indianapolis (18 mo. prorated)*....	\$1,139,000
Annual Lighting Equipment Purchases per Establishment*.....	\$81.30
Total Establishments in United States (Estimated).....	4,500,000
Total Annual Lighting Equipment Sales*	\$362,025,000

* Commercial and industrial lighting equipment only.

TABLE XIII—ANNUAL LIGHTING MARKET IN UNITED STATES

(Based on Average Purchases per 1000 Population as Revealed by Indianapolis Lighting Market Survey)	
Population of Indianapolis (Estimated)*	417,930
Annual Lighting Equipment Sales in Indianapolis (Prorated Average 1948-49)**.....	\$1,139,000
Annual Lighting Equipment Sales per 1000 Population.....	\$2725
Population of United States.....	150,000,000
Total Annual Lighting Equipment Sales**	\$408,750,000

* 1940 population of 386,972 plus 8%.

** Commercial and industrial lighting equipment only.

TABLE XIV—RELIGHTING MARKET POTENTIAL IN U.S.*
 (Based on Indianapolis Lighting Market Survey Data)

	TYPE OF ESTABLISHMENT					Total
	A	B	C	D	E	
1. Number of Establishments in U.S. (000)**	2250	930	870	175	275	4500
2. Establishments with Less Than 30 Ft-c. (Table IV)	74%	70%(a)	84%	71%	74%	77%(b)
3. Total Establishments Inadequately Lighted (000)(c)	1665.0	651.0	730.8	124.25	203.5	3374.55
4. Average Area per Establishment (Table II) (Sq. Ft.)	2,700	10,200	3,340	16,820	15,380	6,350(b)
5. Total Area, All Establishments (Million Sq. Ft.) (c)	4495.5	6640.2	3440.9	2089.9	3129.8	18796.3
6. Ratio Incandescent To Total Luminaires—						
a. Installed and in Use (Table III)	39.5%	87.5%	63.7%	65.3%	82.2%	63.7%(b)
b. Estimated Future Sales (d)	25%	35%	20%	20%	5%	—
7. Ratio Fluorescent to Total Luminaires—						
a. Installed and in Use (Table III)	60.5%	12.5%	36.3%	34.7%	17.8 %	36.3%(b)
b. Estimated Future Sales (d)	75%	65%	80%	80%	95%	—
8. Total Area for Incandescent (Million Sq. Ft.)	1123.9	2324.1	488.2	418.0	156.5	4510.7
9. Total Area for Fluorescent (Million Sq. Ft.)	3371.6	4316.1	1952.7	1671.9	2973.3	14285.6
10. Number of Luminaires per 1000 Sq. Ft. (e)—						
a. Incandescent	12	16	10	10	8	—
b. Fluorescent	8	16	24	18	10	—
11. Cost of Luminaires per 1000 Sq. Ft. (f)—						
a. Incandescent (\$)	120	160	150	80	96	—
b. Fluorescent (\$)	240	320	360	216	300	—
12. Total Relighting Market Potential (g)						
a. Incandescent (Million \$)	134.9	371.9	73.3	33.4	15.0	628.5
b. Fluorescent (Million \$)	809.2	1381.2	703.0	361.1	892.0	4146.5
c. Total (Million \$)	944.1	1753.1	776.3	394.5	907.0	4775.0
13. Average Cost per Sq. Ft.	\$21	\$27	\$32	\$19	\$29	\$23(b)

*—Commercial and industrial lighting only, based on relighting establishments having less than 30 footcandles to an average of 30 footcandles.

**—Estimated, using 1939 U.S. Census figures and classification of establishments per Table I.

(a)—Based on relighting establishments having

less than 20 footcandles to an average of 20 footcandles.

(b)—Weighted averages.

(c)—Covers all establishments considered inadequately lighted.

(d)—Based on current trends toward greater use of fluorescent.

(e)—Using typical luminaires suitable for the various types of establishments which will

provide 30 footcandles average under average conditions.

(f)—Conservative unit costs are used. Probable actual costs may run from 25 to 100 percent more, depending on types of luminaires selected.

(g)—Does not include supplementary lighting, illuminated signs, show window and special lighting, etc.

124,250 inadequately lighted industrial establishments to a minimum of 30 footcandles is increased. The lighting market potential for these plants is estimated at \$394.5 million for lighting equipment only. Installation and rewiring would be extra. There would undoubtedly be a major curtailment of relighting in commercial establishments under such circumstances.

On the other hand, should world peace be achieved in the near future,

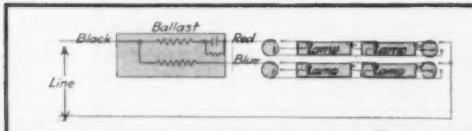
the full relighting market potential of \$4,775 million, based only on relighting the present inadequately lighted establishments to a minimum of 30 footcandles, will exist. In addition, the lighting industry will face the problem of lighting all new construction work, and a demand by many of the relighting customers to provide considerably more than the 30 foot candles of illumination on which this relighting potential estimate is based.

On the following pages are a number of Planned Lighting CASE STUDIES of both industrial and commercial lighting. These Planned Lighting installations are typical of present good lighting practice. Comparison of footcandle intensities, cost per square foot, area per luminaire, etc. in these installations with data from the Indianapolis survey, will show that the lighting market estimates made here are highly conservative.

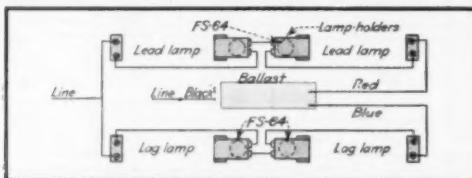
Planned Lighting
CASE STUDY No. 1

Conserving Critical Materials in Lighting Systems*

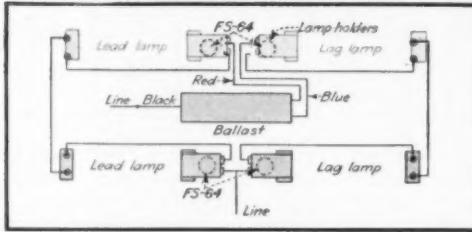
Materials in Lighting Systems*



SCHEMATIC DIAGRAM of the four-lamp sequence start series operation circuit for 85-watt or 100-watt T-17 lamps.



IN FOUR-LAMP LUMINAIRES ballast can be placed in the channel between lamps to simplify wiring.

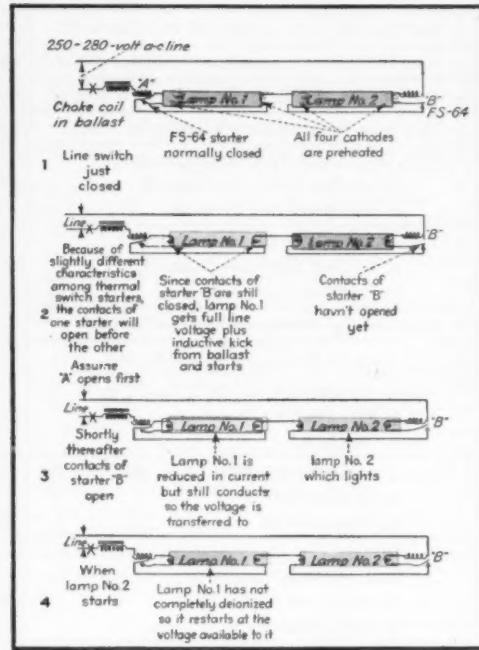


LUMINAIRES installed below 20 feet should be wired with a lag and lead lamp in each luminaire.

DURING World War II industrial plant expansion required huge quantities of critical materials. Conservation of these materials in new plant construction and in all other fields became an urgent necessity, to make them available in the greatest quantities possible for the huge military and armaments program. Then, as now, adequate lighting for work areas to meet new production standards and quotas demanded the fluorescent lamp and auxiliaries. These auxiliaries, commonly called ballasts, require three materials also demanded in huge quantities by the military—iron, copper and aluminum. Because of its high lumen

output, the 100-watt fluorescent lamp was used extensively during the last war in large plants.

Until 1942 the only ballast available for operating the 100-watt lamp was the standard split-phase two-lamp ballast in which lamps were operated in multiple from transformers located in each ballast. In general, large plants utilized "load center" distribution systems and could therefore provide 265 volts to the lighting system. The drive for reduction of critical materials resulted in the design of a relatively light weight ballast which took advantage of the higher voltage distribution system and operated four 100-watt lamps from one ballast through use of the sequence start series operation circuit. The operation of this circuit is



WITH TWO LAMPS connected in series on each leg of ballast, each pair of lamps starts independently of the other pair.

described in the illustrations on this page. The same type of four-lamp ballast is now available for the new 85-watt T-17 fluorescent lamp and provides the greatest savings in critical materials, cost and watts loss of any ballast offered for industrial lighting.

Similar economies, but of less magnitude, can also be made through use of distribution voltages of 208 and 240 volts. One example is the 3/40-watt ballast designed for operation at 208 volts primary on the highly popular 120/208-volt distribution system.

Careful analysis of distribution voltage requirements in new plants, or in old plants being modernized for more efficient production, will often reveal new lighting techniques which offer some savings in critical materials.

*By J. H. Campbell, Lamp Department
General Electric Co., Cleveland, Ohio

LIGHTING 1950

Planned Lighting CASE STUDY No. 2 . . .

THE Alan Wood Steel Company has added a new hot strip mill to its plant at Ivy Rock, Pa., covering approximately 132,000 sq. ft. Combination mercury and incandescent lighting was selected to light the mill area.

The primary seeing task in this area is encountered by the operator in the control tower regulating the speed of the steel plates as they approach the shears. Ten footcandles of illumination were provided and has proved adequate for this task and other operations within this area of the plant.

The 400-watt mercury units are staggered with 750-watt PS-52 clear lamp units, and installed 42 feet from the floor at truss line. A special bracket (right) was developed for mounting the high bay reflectors.

Office areas, maintenance shop and roll shop are lighted with continuous row fluorescent units to provide over 50 foot-candles in these areas.

United Engineers of Philadelphia, Pa., were the engineers and electrical contractors on this job. John Deimler, Alan Wood Steel Co. engineer, and A. V. Schaefer, Philadelphia Electric Co. lighting engineer, cooperated with United Engineers in the design of the lighting system.

Lighting A Steel Mill



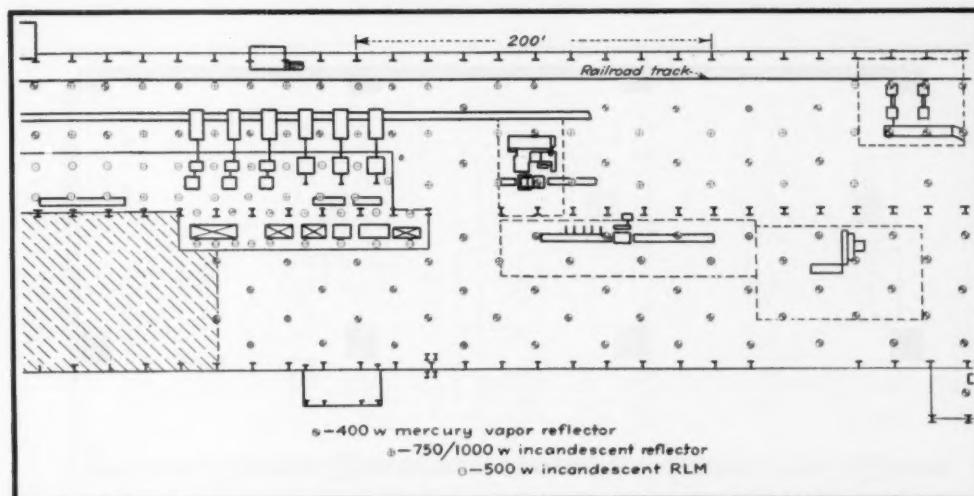
MERCURY-INCANDESCENT reflectors light the hot strip mill of Alan Wood Steel Co., Ivy Rock, Pa. Intensity is approximately 10 footcandles.



MERCURY UNIT ASSEMBLY

TECHNICAL DATA

Type of Work.....	Steel Strip Mill
Area	132,000 Sq. Ft.
Luminaire Mounting Height.....	42 Ft.
Light Sources.....	Inc. & Mercury
Size Lamps..	500 & 750 w. Inc, 400 w. Hg
Type Luminaire.....	Benjamin "Steelite"
Luminaire Spacings	
	Staggered (See Layout)
Watts per Sq. Ft.....	Approx. 1.1
Illumination (Footcandles).....	10 to 15
Area per Luminaire (Sq. Ft.).....	560
Cost per Sq. Ft. for	
Lighting Equipment Only,	
Uninstalled	\$0.10



LIGHTING LAYOUT is based on a combination of 400-watt mercury vapor units and 750/1000-watt incandescent units on a two-to-one basis respectively. Benjamin Steelite reflectors and General Electric single-lamp transformers are used.

Planned Lighting
CASE STUDY No. 3.

Metal Working

In the Lanston Monotype Machine Co. plant in Philadelphia, Pa., nearly 1200 2/40-watt and 3/40-watt Benjamin porcelain enameled steel fluorescent lighting reflectors have been used to light the various work areas. Covering five floors, these work areas have all been considered separately in planning the lighting layouts, so that lighting intensities ranging from 40 to 60 footcandles are obtained at points where light is most needed. In some areas, such as the turning department, machines have been lined up in rows and the lighting in turn is installed in modified continuous rows. In other areas, such as the drilling and milling machine departments, individual lighting units have been located with respect to the machines so that maximum intensity is obtained on the work areas at the machines. This results in grid layouts and varied spacing of individual units in these departments.

This new lighting installation is a refighting project. Before modernization many of the machines were powered from old line shafts. Part of the modernization work involved installation of individual motors on the machines and doing away with the old line shaft drives. Bus duct was installed throughout to supply the motor loads,

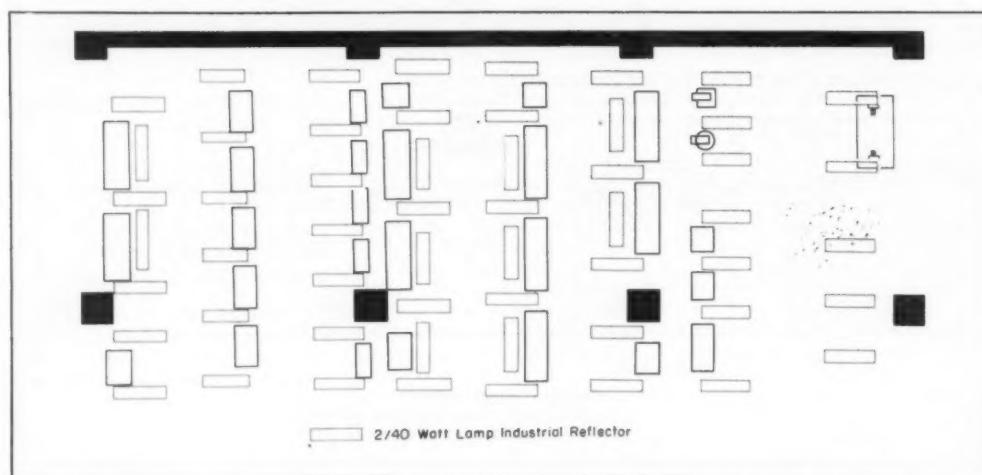


WHITE PORCELAIN reflectors are located with respect to machines at Lanston Monotype Machine Co., Philadelphia, Pa., to provide efficient lighting.

and the new lighting system was installed at the same time. Power for lighting is supplied from the bus duct to Trol-E-Duct, and from the Trol-E-Duct to the individual lighting units. Flexible cord with 3-ampere fusible plugs connect the reflector units to the 50-amp. Trol-E-Ducts electrically. Re-

flectors are installed nine to ten feet from the floor and are suspended from the 13-foot high ceiling by means of fixture chain.

Trol-E-Duct is usually attached directly to the ceiling by a standard clamp-on type hanger, or to a messenger cable by a similar type hanger.



LIGHTING LAYOUT in drilling department is based on individual 2/40-watt RLMs installed in grid pattern on 8 ft. centers.

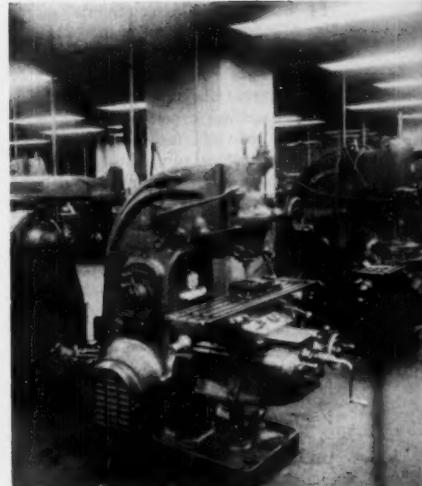
Shop Lighting



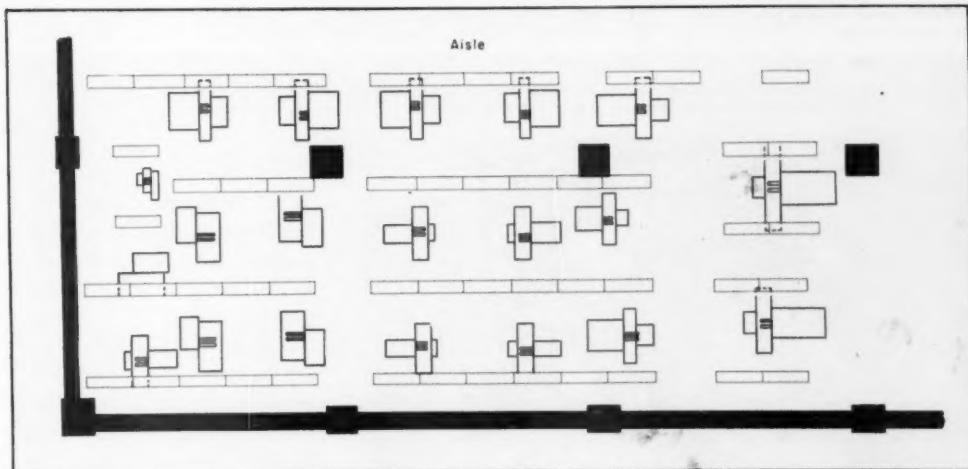
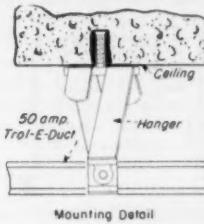
INDIVIDUAL industrial fluorescent lighting reflectors installed in modified continuous rows light machines effectively in the turning department.

equipped with a flat steel saddle strap. Thomas H. Cook, Langston's chief electrician, developed a special T-support for embedding in the concrete ceiling to which the Trol-E-Duct is attached by a standard messenger cable hanger. This special device provides a rigid support for the duct.

D. M. Hoffman, illuminating engineer of the Philadelphia Electric Company's Lighting Application Section cooperated with Langston engineers in the design and layout of the lighting system. The lighting throughout all five floors of the plant reflects the advantages of careful planning.



CLOSE-UP view of milling machine shows abundance of diffuse light where needed.



REFLECTORS in the milling machine department are installed in single and multiple units as required to light work areas.

Planned Lighting CASE STUDY No. 4

WESTERN ELECTRIC Company's new "controlled conditions" plant in Allentown, Pa., is devoted chiefly to assembly of electronic products. So sensitive are these products to moisture and dust that the entire plant is sound-, light- and air-conditioned and employees wear special lint-free smocks.

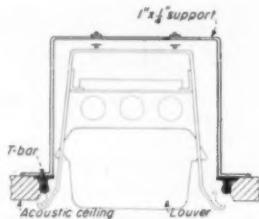
A wide range of lighting requirements has been met by the installation of 45 footcandles of general lighting throughout, supplemented by individual bench lamps and integral machine lighting to produce from 90 to 100 footcandles at some points. The general lighting is provided by modified continuous row fluorescent troffers recessed in the 18-foot high acoustic ceiling. Over 13,000 40-watt fluorescent lamps are used throughout the plant for the general lighting only.

Engineers and Builders—The Austin Co., New York, N. Y.; *Electrical Contractor*—H. P. Foley Co., Philadelphia, Pa.

Assembly Lighting



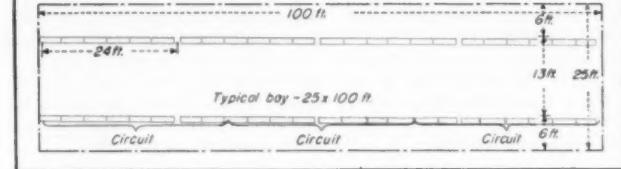
GENERAL and local lighting are used in the specially constructed controlled-atmosphere manufacturing plant of Western Electric Co., Allentown, Pa.



SECTION through snap-in type troffers with lateral louver.

RECESSED troffers provide general lighting. Two rows light each typical 25-ft. by 100-ft. bay. Each row contains 24 3/40-watt louvered deep type troffers.

LOCAL lighting provides 45 footcandles for operators preparing tiny cathodes to receive a thermionic coating in spray booth at rear of rotating platform.



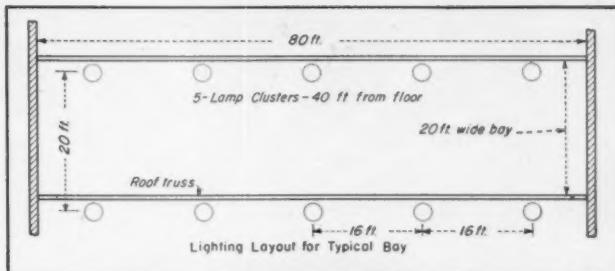
TECHNICAL DATA

Type of Work	Electronics Production
Location	High Bay Area, Main Floor
Area (Sq. Ft.)	130,000
Ceiling Height	18 Ft.
Light Sources	Fluorescent
Size Lamps	40 w T-12
Luminaires	DayBrite 3-Lamp Troffers
Watts per Sq. Ft.	.21
Illumination (Footcandles)	45
Area per 3/40-watt Luminaire (Sq. Ft.)	.52

Planned Lighting

CASE STUDY No. 5,

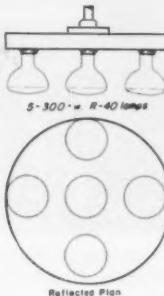
Iron Foundry Lighting



TYPICAL BAY is 20 feet wide, 80 feet long, 40 feet high, and is lighted by five 5-lamp 1500-watt clusters installed at truss level.

TECHNICAL DATA

Type of Work.....	Iron Foundry
Area—80 Ft x 520 Ft.....	41,600 Sq. Ft.
Ceiling Height	45 Ft.
Light Source. Incandescent Reflector Flood	
Size Lamps.....	300-w. R40
Type Luminaires.....	Bare Lamp
Luminaire Spacing.....	16 Ft. x 20 Ft.
Watts per Sq. Ft.....	4.5
Illumination (Footcandles).....	40
Area per Luminaire (Sq. Ft.).....	320
Cost per Sq. Ft.—	
Lighting Equipment and Electrical	
Work	\$19



DETAIL of 5-lamp cluster using five 300-watt R-40 floodlamps.

LIGHTED to an intensity of 40 foot-candles, this 41,600 sq. ft. General Electric Co. iron foundry uses a minimum of materials in the lighting units. Each unit consists of five 300-watt R-40 reflector flood lamps hung from a circular metal plate without a conventional reflector. Each lamp has its own sealed-in reflector, which simplifies maintenance, as the hot surface of the lamp does not attract dirt.

This foundry is divided into 26 bays. Each bay is lighted by five 5-lamp clusters. Separate 125-volt single phase circuits are run to each cluster. Each bay is supplied from a separate three-wire panel box and 10 kva 550-125/250-volt dry type transformer mounted in the roof trusses. Each transformer is controlled by a fused primary safety switch located six feet above the floor. Primary power to transformers is supplied by the main 550-volt three phase shop line.

This type of lighting has been found particularly satisfactory for foundries or welding shops where the great amount of smoke and dirt makes it almost impossible to maintain ordinary lighting fixtures. Maintenance is reduced to simple problem of replacing burned-out lamps only.

NEW LIGHTING technique is used to light the General Electric Co.'s Schenectady Works' Iron Foundry. Installation consists of five rows of 1500-watt clusters in the 520-foot long shop, mounted 40 feet above the floor. Intensity of 40 footcandles is obtained with 4.5 watts per sq. ft. Installation of new lamps automatically restores initial efficiency.



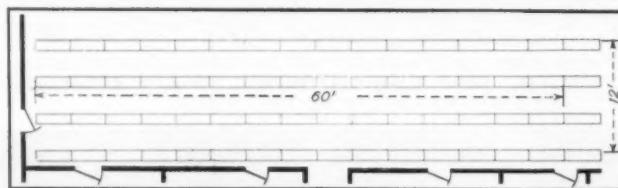
Planned Lighting

CASE STUDY No. 6

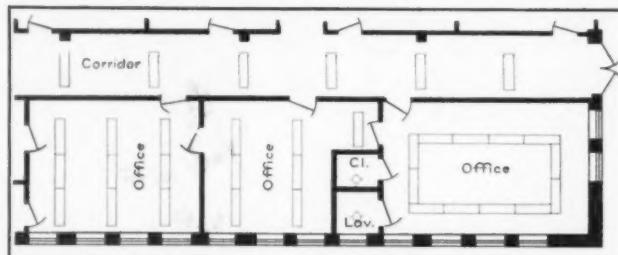
Industrial Plant



LOW BRIGHTNESS TROFFERS recessed in acoustical ceilings provide high level comfortable illumination in general and private offices of Yale & Towne Manufacturing Co.'s Boulevard plant, Philadelphia, Pa.



LIGHTING LAYOUT for general office areas is based on single-lamp louvered troffers and 50 footcandles intensity. Continuous rows are on four foot centers.

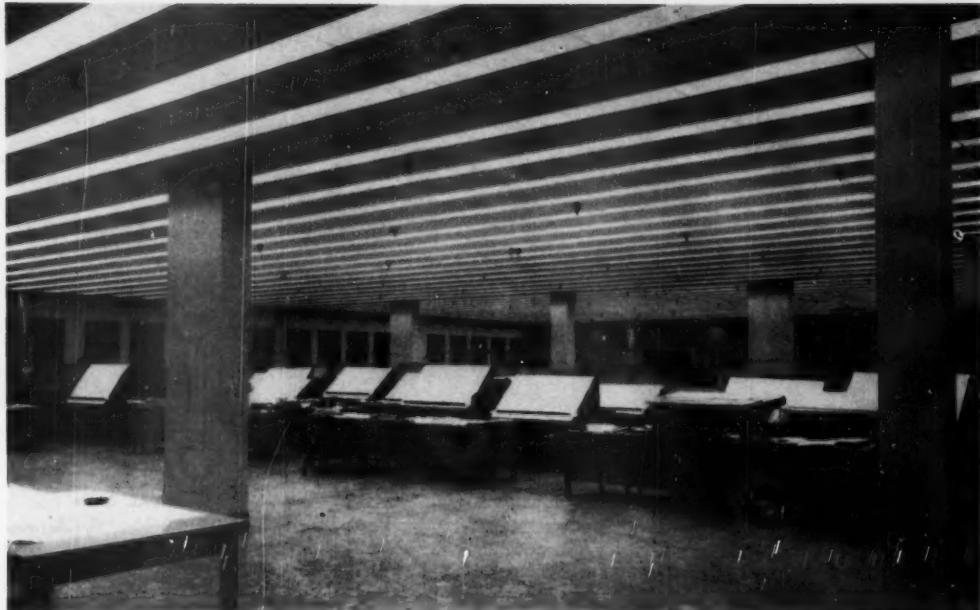


PRIVATE OFFICES also use recessed troffers in continuous rows and geometric patterns. Intensities range from 35 to 50 footcandles.

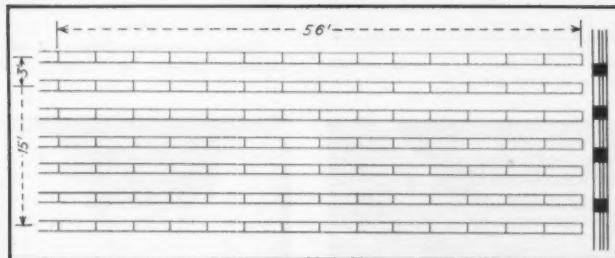
THE lighting of industrial plants embraces a wide range of lighting problems and lighting techniques. This is well illustrated in the new Roosevelt Boulevard plant of the Yale & Towne Mfg. Co., Philadelphia, Pa. In addition to the lighting covered in this Planned Lighting study, this plant also had the problem of lighting a reception room, display room, conference room, small infirmary or hospital unit for employees, outdoor grounds and protective lighting, loading areas on a railroad spur track coming into the plant, and many other miscellaneous areas in both the production department and office building area. Total cost of all lighting equipment only is nearly \$200,000, or about 15% of the total electrical construction cost of \$1,300,000.

Probably the best lighted area in this plant is the drafting room. Here the average intensity is 70 footcandles, provided by continuous row single-lamp fluorescent recessed troffers

Lighting



DRAFTING ROOM is lighted to 70 footcandles average. Low brightness single lamp deep troffers with semi-specular aluminum reflectors are used which provide high efficiency and easy maintenance. Shadows are practically eliminated.

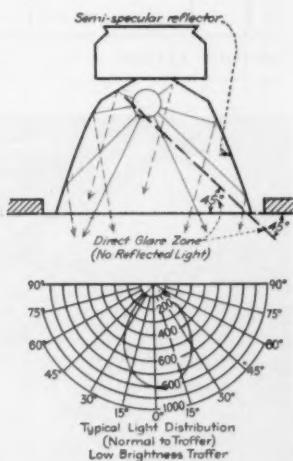


LIGHTING LAYOUT in drafting room is based on recessed single lamp troffers spaced three feet on centers.

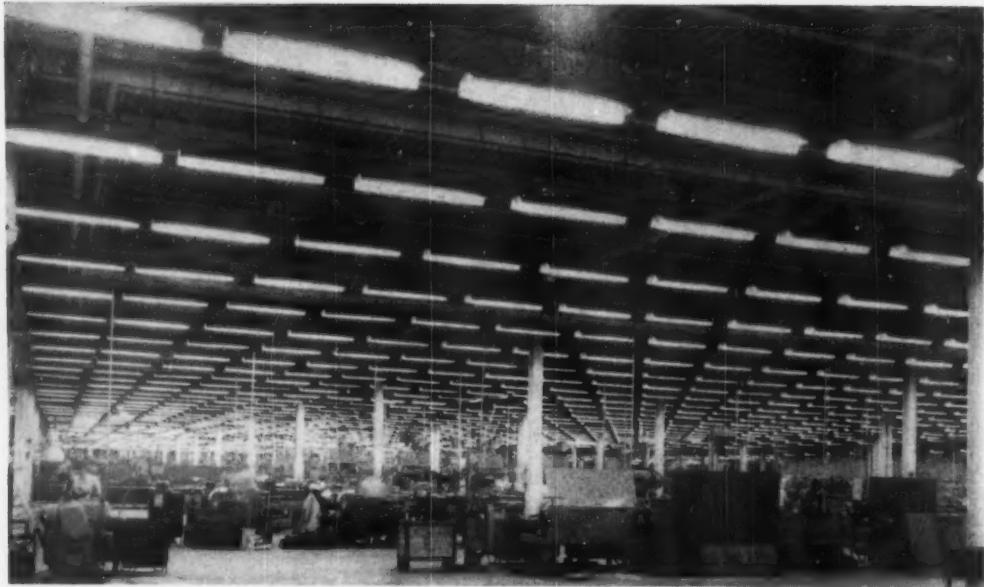
spaced three feet on centers. Shadows and direct glare are completely eliminated, and an efficiency of about 19 footcandles per watt per square foot maintained is achieved. This system was selected and approved only after a visit to other installations of this type with representatives of architects and engineers. The same type of lighting system was adopted for office areas;

TECHNICAL DATA

Type of Work	Drafting
Construction	New
Area—Drafting Room (Sq. Ft.)	11,900*
Luminaire Mounting Height	11 Ft.
Light Sources	Fluorescent
Size Lamps	40 W. T-12
Luminaires	Miller LB Troffers
Watts per Sq. Ft.	3.7
Illumination (Footcandles)	.70
Cost per Sq. Ft.—	
Lighting Equipment Only,	
Uninstalled	\$1.68
Area per 1/40 w Luminaire (Sq. Ft.)	12



LIGHT CONTROL principle of the low brightness troffer eliminates direct glare in normal line of vision.



GENERAL SHOP area of plant is lighted with individual fluorescent 2/40-watt and 3/40-watt porcelain enameled steel reflectors to intensity of 25 to 30 footcandles. Mounting height is 13 feet. Flexible cords connect units to trolley duct.



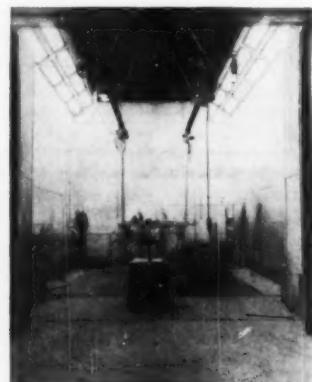
LIGHTING LAYOUT in manufacturing area shows individual units spaced end-to-end in some areas, and on 10-foot centers in other areas.

TECHNICAL DATA

Type of Work	Manufacturing
Construction	New
Area (Sq. Ft.)—	
Fluorescent Lighted.....	276,060
Luminaires Mounting Height.....	13 Ft.
Light Sources	Fluorescent
Size Lamps.....	40 w T-12
Luminaires.....	Miller 2/40-w Porcelain
Watts per Sq. Ft. (Ave.).....	1.3
Illumination (Footcandles).....	25 to 30
Cost per Sq. Ft. (Ave.)—	
Lighting Equipment Only.....	\$0.28
Area per Luminaire (Sq. Ft. Ave.).....	80



PORCELAIN REFLECTORS equipped with eight-foot cold cathode fluorescent lamps are used to light storage areas, and to reduce maintenance, due to high mounting height. Reflectors are maintained from crane.



SPRAY BOOTHS are lighted with vapor-proof fluorescent units installed at an angle at top of booths.



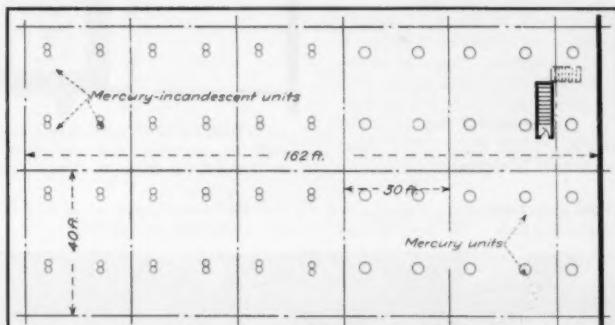
HIGH BAY areas are lighted to 30 footcandles intensity average with combination mercury vapor and incandescent units. Miller high bay aluminum reflectors are used for both light sources. Units are installed 22 feet from floor.

TECHNICAL DATA

Type of Work	Manufacturing
Construction	New
Area (Sq. Ft.).....	84,180
Luminaire Mounting Height.....	22 ft.
Light Sources.....	Inc. and Mercury
Size Lamps.....	300 w Inc.-400 w AH1
Luminaires.....	Miller Aluminum High Bay
Watts per Sq. Ft.....	3.0
Illumination (Footcandles)	30
Cost per Sq. Ft.—	
Lighting Equipment Only.....	\$0.14
Area per Luminaire (Sq. Ft.).....	300

spaced so as to provide 35 to 50 footcandles in private offices and 50 footcandles maintained in general office areas.

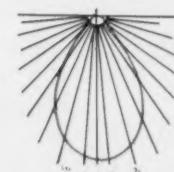
Modern industrial lighting was also selected for the manufacturing and production areas. The main shop area is lighted to intensities of 25 to 50 footcandles, depending upon the type of work being done in the various parts of the shop. Porcelain enameled 2/40-watt and 3/40-watt RLM reflectors, installed on spacings of ten feet by ten feet for individual units, and ten feet apart for continuous rows, are used for lighting a major part of the shop area. High bay aluminum reflectors, equipped with 400-watt type AH1 mercury vapor lamps or 300-1000 watt incandescent lamps are used to light high bay areas generally. Both



LIGHTING LAYOUT in high bay areas uses both single and two-reflector units. Layout is based on two mercury lumens for one incandescent lumen for good color.

single and two-reflector units are used, depending upon the amount and quality of light needed in the various locations. Incandescent wattages are varied to provide approximately two mercury lumens for each incandescent lumen to insure a good color quality of light in the areas lighted by a combination of mercury and incandescent.

Architects and Engineers—The Ballinger Co.; *Electrical Contractor*—Walter V. Pangborne & Co., Inc.; *Lighting Consultant*—G. Wm. Wagner, The Philadelphia Electric Co.; *Yale & Towne Mfg. Co.*—J. C. Morgan, General Manager, and C. S. Schroeder, Plant Engineer, all of Philadelphia, Pa.



COMBINATION mercury-incandescent two-reflector unit and light distribution.

LIGHTING 1950

Planned Lighting

CASE STUDY No. 7

FIRST Federal Savings and Loan Association's new quarters in New Haven, Conn., were built inside an old church building. A flat coffered ceiling built across the former nave, lighting integrated with architecture, and other architectural features serve to provide a modern Swedish design interior well adapted for banking.

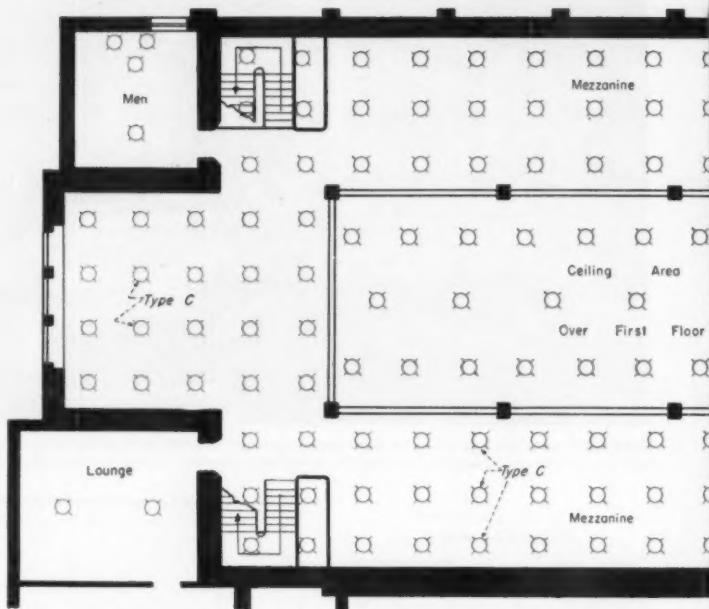
Semi-recessed Guth troffers light the banking and business areas. Concealed Rambusch Downlights, with bottom shield parts removed, project light through a four inch diameter aperture to effectively light the center public area from the 25-foot high ceiling.

Precast five-foot square white coffers over mezzanine contain a 150 watt bowl silvered lamp and 30-inch square egg-crate louver for shielding, and provide 25 footcandles average.

Architect—R. W. Foote (deceased); Consultant on Design—Andrew F. Euston; Consulting Engineer—Frederick M. Hill, Hill & Harrigan; Electrical Contractor—M. B. Foster Electric Co.; Illuminating Engineer cooperating on lighting design—S. F. MacLean, United Illuminating Co.

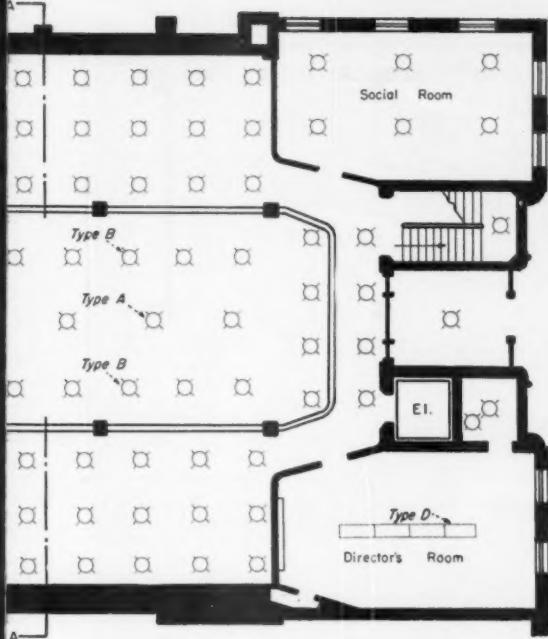
CUSTOM LIGHTING effect is obtained in this two-floor banking area by the skillful integration of standard lighting elements and architectural details. The lighting result is most comfortable and pleasing.

Lighting A Bank

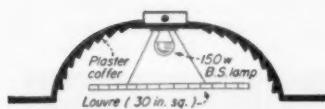


LIGHTING LAYOUT for ceiling over mezzanine floor includes individual coffers over the mezzanine and over the first floor area. Details of coffers Types A, B and C are shown on opposite page.

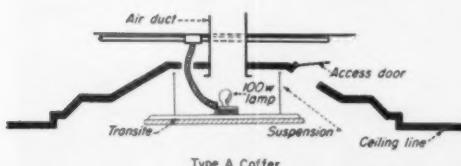




MEZZANINE FLOOR PLAN

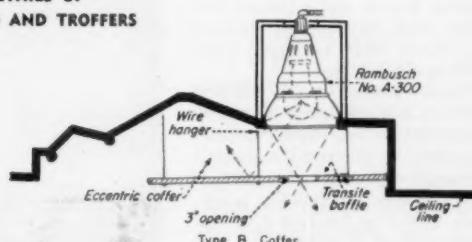


Type C Coffers



Type A Coffers

DETAILS OF COFFERS AND TROFFERS



TECHNICAL DATA

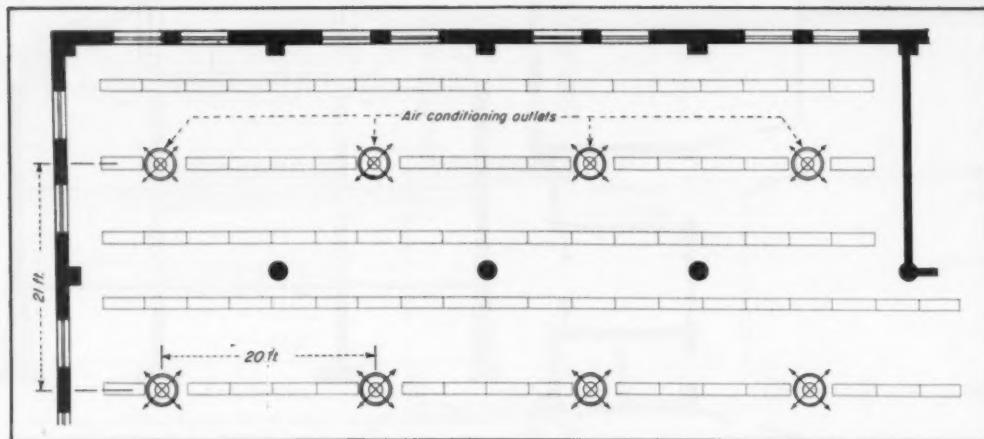
Type of Work	Office & Clerical
Area (Sq. Ft.)	Approx. 12,000
Luminaire Mounting Height—	
Public Area	25 Ft.
Mezzanine Floor	12 Ft.
Under Mezzanine (First Floor)	10 Ft.-6 in.
Light Sources	Inc. & Fluorescent
Size Lamps	Fluorescent 40 w T-12 Inc.—150 w Bowl Silvered & 300 w

Type Luminaires—Troffers	Guth
Downlights	Rambusch
Egg Crate Louvers	Fullerton
Luminaire Spacings	See Layouts
Watts per Sq. Ft.—	
Public Area	3.9
Mezzanine Floor	3.8
Under Mezzanine (First Floor)	4.2
Illumination (Footcandles)—	
Public Area (Ave.)	22

Mezzanine Floor (Ave.)	25
Under Mezzanine (Ave.)	45
Cost per Sq. Ft. (Entire Building)—	
Lighting Equipment Only	\$0.84
Electrical Work Only	1.25
Lighting Equipment & Electrical Work	
	\$2.09
Percent, Lighting & Electrical to Total Cost	7%

Planned Lighting
CASE STUDY No. 8 . . .

Office Building Lighting



GENERAL OFFICES of American States Insurance Co.'s new office addition in Indianapolis, Ind. are lighted by recessed 2/40-watt Smithcraft troffers spaced on 11.5-foot centers average. Troffers are lined up with air-conditioning outlets.

THE new addition to the office building of the American States Insurance Company, Indianapolis, Ind., is typical of office building layout, construction, facilities and lighting. This addition is one story and basement only, but is designed so that additional floors may be added later if needed. The first floor is devoted to general office space and rest rooms, while a cafeteria, kitchen, and a general conference room occupies the basement area. Private offices are housed in the adjoining old building.

A street entrance lobby to this new addition is brightly lighted to over 50 footcandles by a louvered ceiling lighting system, which extends a cheerful welcome to employees and visitors.

The first floor general office is artificially lighted by louvered 2/40-watt troffers recessed in an acoustical ceiling. Troffers are spaced so that the continuous rows tie in with the air conditioning system outlets and present a harmonious layout pattern. This general office is also daylighted by glass window areas on three sides of the room. Prismatic glass blocks extend along the entire window area, and reflect daylight to the ceiling. A two-foot band of clear glass is installed below the line of glass blocks along each of the three sides, to permit vision

of employees to the outside. The troffer lighting system is kept turned on at all times when the general office area is in use, so that the daylight merely adds to the general illumination.

Low level cove lighting is used in the cafeteria and basement conference room. Coves extend around the peri-

meter of these rooms and around the capitals of the large columns providing comfortable indirect lighting.

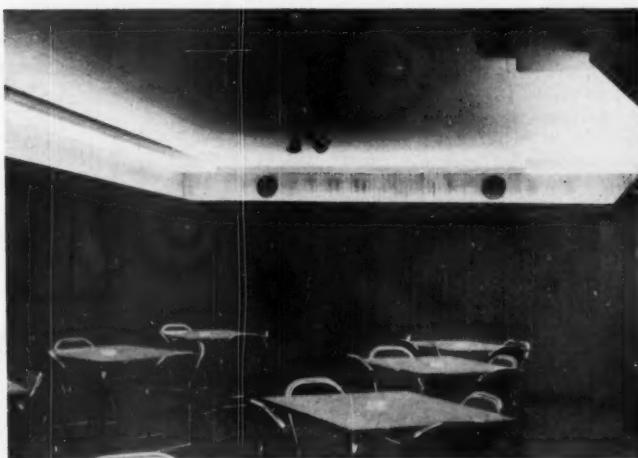
Architect—McGuire & Shook and Associates; Consulting Engineer—J. M. Rotz Engineering Co.; Electrical Contractor—Pearson Electric Service; all of Indianapolis, Ind.



COVE LIGHTING provides restful atmosphere in pine-paneled cafeteria. Cove contains two rows of 15 mm. Zeon cold cathode tubing, operated at 30 ma. by 9000 and 12000 volt transformers. Intensity is approximately ten footcandles.



CONTINUOUS ROW troffers with egg-crate louver shielding insure eye comfort for employees in the general office area. Light-intensity is 55 footcandles average and well diffused over the entire floor area, permitting maximum utilization of all floor space. With troffers recessed flush in the acoustical ceiling, a clean architectural appearance is maintained.



COLD CATHODE fluorescent tubing in coves and R-40 adjustable spots on ceiling provide flexible lighting for the Conference and Meeting Room. Other features include concealed screen and electrical outlets for projectors.

TECHNICAL DATA

Type of Work.....	Office
Construction	New
Area—Office Only (Sq. Ft.).....	12,500
Luminaire Mounting Height..10 Ft.-4 in.	
Light Sources	Fluorescent
Size Lamps	40 w T-12
Luminaires .. Smithcraft 2-Lamp Troffers	
Watts per Sq. Ft.—Office Only.....	3.1
Illumination (Footcandles)	55
Cost per Sq. Ft.—Office Only	
a. Lighting Equipment.....	\$0.72
b. Electrical Work.....	0.60
c. Total	\$1.32
Percent, Lighting & Electrical Work to Total Construction Cost, Entire Building	5.8%

Planned Lighting CASE STUDY No. 9 . . .

SPEAKING from experience Justin S. Pagel, owner of S. Pagel & Son Shoe Store, Norristown, Pa., says "Store modernization is an extremely important factor in increasing shoe sales and maintaining good customer relations." Modernized for the fifth time in its 71-year history, this modern salon has truly paced lighting progress since it was first established in 1879.

For nearly three quarters of a century the S. Pagel & Son store has been a tradition for fine shoes in Norristown. Frequent remodeling of the small building housing this store has been a familiar sight to the older residents who welcome the determination of a successful merchant to keep abreast of the times.

TECHNICAL DATA

Type of Work	Sales Construction
Area (Sq. Ft.)	910
Ceiling Height	9 Ft.
Light Sources	Fluorescent and Inc.
Size Lamps	Misc. and 96-in. T-12 Slimline
Luminaires	Globe, Swivelier, Pittsburgh
Watts per Sq. Ft.—	
a. Fluorescent	1.7
b. Incandescent	4.5
c. Total	6.2
Illumination (Footcandles)—	
Women's Dept.—Center area	56
Side Walls	30
Accent Areas	140-160
Display Niches	46
Entrance	64
Men's Dept.—Center Area	32
Side Walls	13
Display Niches	35
Cashier's Counter	71

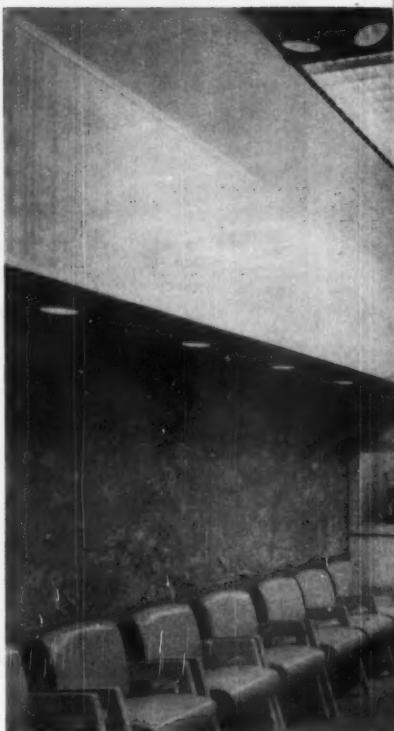
Kerosene lamps provided the illumination for this store when it opened for business in 1879. Then, when gas lighting arrived, it was installed to replace the oil lamps, and new floor and wall cases were also installed. Combination gas-electric fixtures were next installed, the gas mantles being retained as a standby for unreliable electric power. Later changes were to enclosing glass globe fixtures, to semi-indirect glass luminaries, and finally, when fluorescent lighting was introduced, to unshielded fluorescent units.

Progress in lighting postwar soon made the glaring bare lamp fluorescent luminaries obsolete. So in 1949 a complete remodeling of the building was made, including installation of combination fluorescent-incandescent luminaires and concealed reflectors and strip lights.

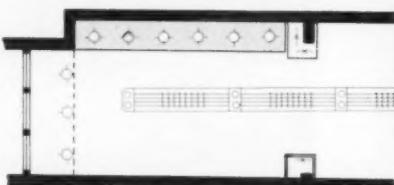
In remodeling the old 72-foot long store, its length was reduced to 65 feet and the width was expanded from 13 to 14 feet. Rear of the store was converted to storage area, and the main part of the store divided into two areas—one for ladies and children in the front section, the other for a Men's Shop at the rear. Removal of an old stairway permitted wider width.

General lighting in the front section is by three 96-inch T-12 425 ma. 4-lamp Globe luminaires, containing four double PAR-38 adjustable spots. Recessed 200 watt Pittsburgh louvered reflectors light the Men's Shop. Accent lighting is provided by Swivelier units recessed in a side soffit and at the store entrance. Wall niches and mirrors are lighted by suitable lengths of fluorescent light strips. Illumination values and other data are shown at left.

Shoe Store

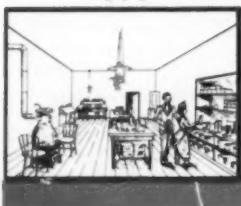


MODERN LIGHTING has been featured in the remodeled S. Pagel &



LIGHTING LAYOUT shows how light-

1879



1904



1928

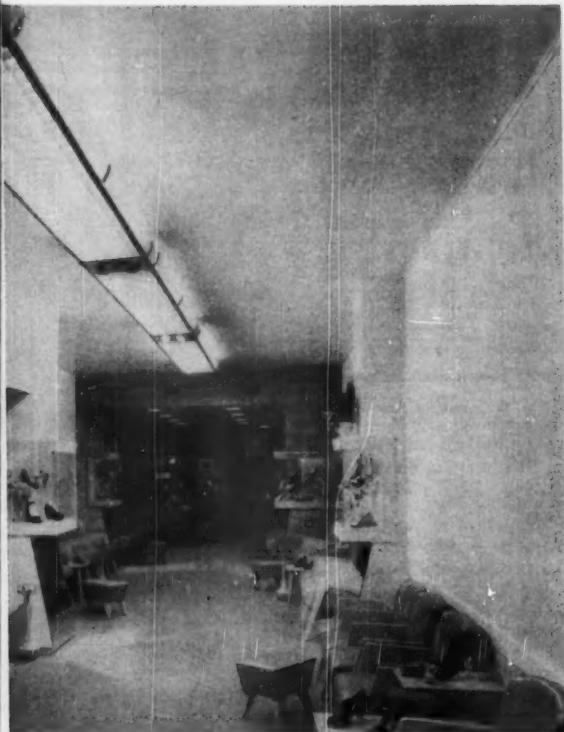


1935

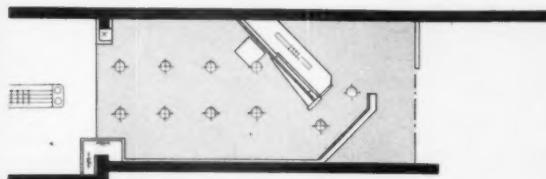


S. PAGEL & SON INC. SHOWS STAGE BY STAGE THE PROGRESS AS LIGHTING

Lighting



Son Shoe Store, Norristown, Pa. Fluorescent and incandescent sources are combined to provide ideal light for selling.

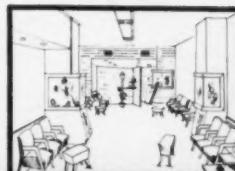


ing units are located functionally for best results.

1942



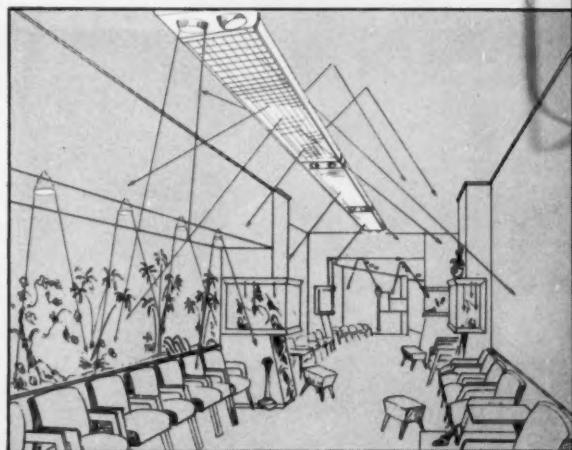
1949



RECESSED incandescent reflectors provide over 30 ft-c. of general illumination in Men's Shop at rear of store.



BARE LAMP fluorescent luminaires installed in 1942 were considered obsolete for today's modern salon.



CENTER LUMINAIRES provide general illumination while reflector spot lamps and strip lights provide accent lighting.

LIGHTING 1950

Planned Lighting

CASE STUDY No. 10

Class Room Lighting



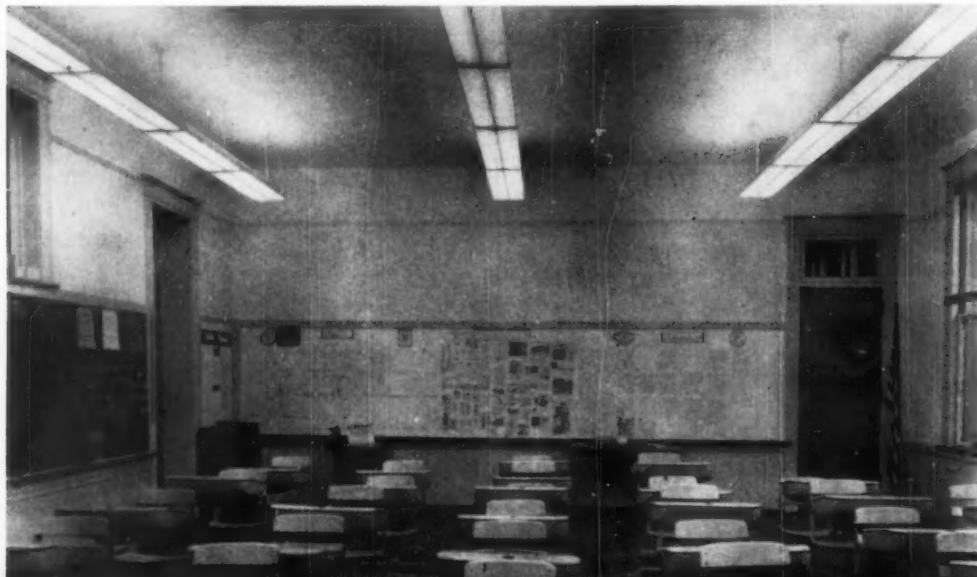
BEFORE view of typical class room in Fulton School, Toledo (Ohio) City School System.

As a result of modernization of a typical class room in the Fulton School, Toledo, Ohio, Toledo citizens have voted a school levy of \$750,000 for relighting their city schools. The model class room (below) has an 80 percent white ceiling, 65 percent blue side walls, 40 to 50 percent new light finished desks, and a 20 percent bleached floor. A new slate chalk board was also installed. Light finishes increased the lighting efficiency.

As demonstrated here, good lighting is more than a matter of installing new lighting equipment. It also involves comfortable brightness ratios which are achieved by using light finishes for all room surfaces.

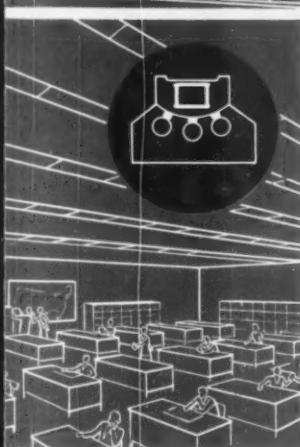
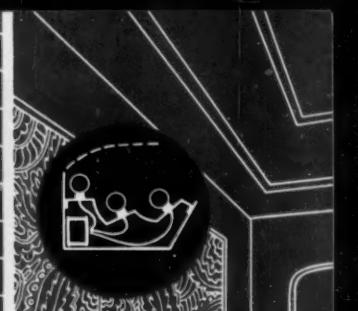
Modernization of this class room was a cooperative venture. It was participated in by Toledo Edison Co., the Toledo Board of Education, Curtis Lighting, Inc., and the electrical contractor, Eggleston & Son.

AFTER modernization class room was comfortably lighted, floors were bleached, ceiling and walls repainted, slate chalk boards and new desks installed. Visual conditions were greatly improved with low brightness-contrast ratios.



TECHNICAL DATA

Type of Work	Classroom
Construction	Remodel
Area—Classroom Only (Sq. Ft.)	903
Ceiling Height	12 Ft.
Light Sources	Fluorescent 3500°
Size Lamps	40 w T-12
Luminaires	Curtis No. 40/63
Watts per Sq. Ft.	.23
Illumination (Footcandles)	46
Area per 2/40-watt Luminaire (Sq. Ft.)	.43



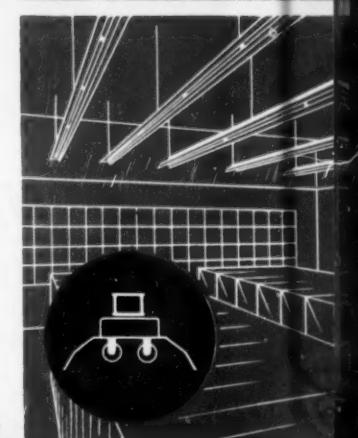
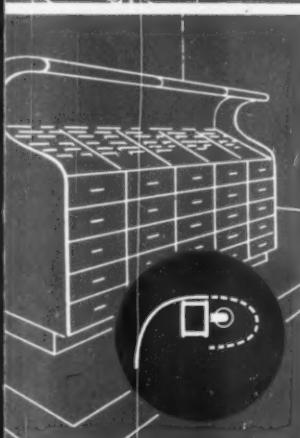
Versatile NE Surfaceduct offers the lighting engineer a 2-piece surface raceway unsurpassed for convenience, sturdiness, circuit roominess and accessibility. It is readily adapted to any kind of an installation or lighting fixture. May be used in either exposed or concealed locations. Unique bridge locks capping securely in place yet permits easy removal for future service additions.

Eight device covers accommodate over 300 manufacturers devices. Twelve simple fittings meet all job requirements. Over-all dimensions: $1\frac{5}{8}'' \times 2\frac{1}{8}''$. Capacity with devices installed: Ten #10, #12 or #14 wires. Designed for loads up to 60 amp. Write for complete catalog.

*Leading electrical wholesalers
have stocks for immediate delivery.*

National Electric Products Corporation

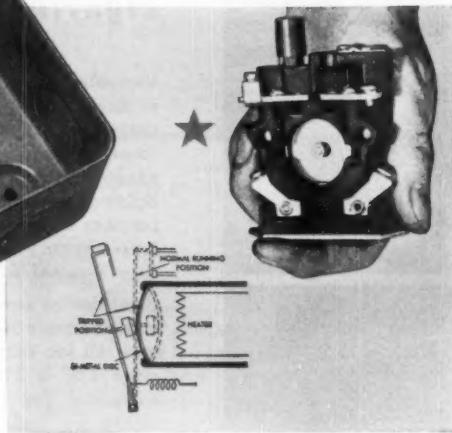
1301 CHAMBER OF COMMERCE BUILDING
PITTSBURGH 19, PA.



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Westinghouse

CUT MOTOR BURNOUTS



with the Life-Linestarter*

... positive protection against overloads

Stop worrying about the inconsistencies of ordinary overload relays.

Investigate the new Westinghouse Life-Linestarter with the bi-metal DISC overload relay which provides a positive contact pressure, with snap action. It retains its precise calibration regardless of the number of operations. It's the only relay that may be set for "automatic", "hand" or "no-stop" operation.

Positive protection is but one of the advanced features offered by the new Life-Linestarter. It's best because of its uniformity and completeness of line (NEMA sizes 0 through 4, to 100 hp, 600 volts), superior performance, ease of installation and other cost-saving advantages.

*Trade Mark

Ask your nearby Westinghouse representative for the "inside story"—a Trans-Vision presentation—at your convenience. Or write for booklet B-4677. Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pa.

J-30024

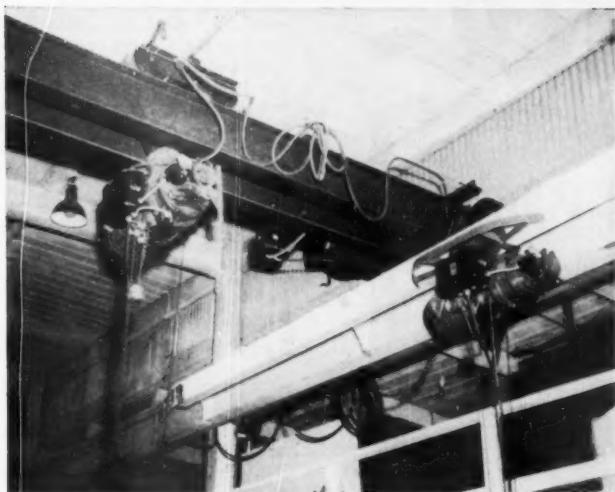
Westinghouse

life-linestarter

METAL DISC
HEATER
BI-METAL DISC
NORMAL RUNNING POSITION
STOPPED POSITION

TOMORROW'S STARTER—TODAY!

Practical Methods



COILED POWER CABLES connect hoist motors with fixed sources of current and are supported by rings that slide along a messenger cable. Power cables automatically coil when hoist motors approach power sources.

Crane Design Aids Materials Handling

HOISTING

Handling electrical equipment and materials is facilitated for the California Electric Company, Oakland, California, by two overhead rolling hoists located independently of each other at different elevations. The top crane covers the entire working and storage areas while the hoist directly below it serves a local area between more-frequently used work centers.

To supply power to the hoist motors, rubber covered cables extend from the fixed sources of supply and the moving lifting units. These cables pass through a series of sliding rings supported by a cable running along the travel line of the crane so served. When the crane moves away from the source of power, the rings slide along the supporting cable and the rubber-covered power line is straightened out. When the hoist moves towards the power source, the power cable assumes a coiled condition and the supporting rings become bunched together.

Both cranes are remotely controlled by pushbutton boxes developed by California Electric. These operating stations consist of four micro switches contained in a rubber-encased steel box. Switches control both vertical and horizontal movement of the hoist hook,

and they are activated by finger pressure through the rubber casement. The rubber casing protects the switches from accidental damage and keeps excess oil and dirt from the controls.

The casing is primarily supported by a light, flexible chain, relieving the control cable of strain.



RUBBER COVERED CONTROL consists of four micro switches for motivating changes in crane movement. Rubber casing protects switches from damage, dirt and oil. Control was developed by California Electric Co., Oakland.

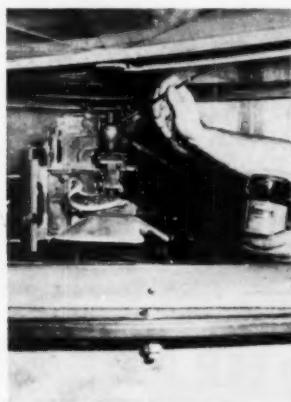
High Temperature Lubrication

MAINTENANCE

In New York's Times Square is the famous Eveready flashlight sign, which has now been seen in operation at night by millions of visitors. The huge flashlight in this sign contains a searchlight which produces an 800

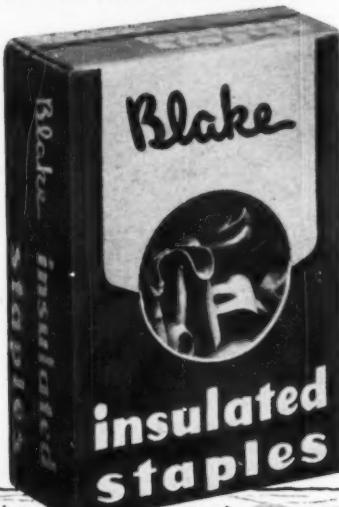


LIGHT BEAM of 800 million candle-power intensity emanates from huge Eveready flashlight on Times Square sign, New York City.



LUBRICATION of planetary gears controlling movement of carbon electrodes in the searchlight inside the Eveready sign flashlight is done with Aquadag, which withstands the light's 1500°-2000° F temperature range.

when
Blake
is on
the job
Your job
is
easier



The name Blake identifies genuine insulated staples — the staples that drive true. Ask for them — insist on them. The quality's there — they cost no more.

BLAKE INSULATED STAPLES
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 DEPT. 810 NORTH QUINCY 71, MASS.

Private telephones for home and office . . . hospital signaling systems . . . apartment house telephones and mail boxes . . . fire alarm systems for industrial plants and public buildings.

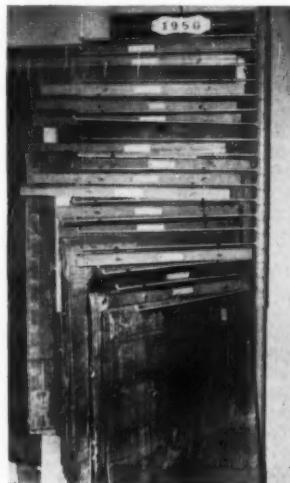
million candlepower beam that extends five and one-half miles into the sky on clear nights.

This powerful searchlight uses carbon electrodes to produce this exceptionally high candlepower beam. Movement of the electrodes is controlled by planetary gears, which require lubrication for continued successful operation. The light's temperature ranges from 1500 to 2000 degrees Fahrenheit, so that ordinary petroleum lubricants are not satisfactory for lubrication maintenance. It has been found that Aquadag, which is a dispersion of colloidal graphite in water, provides a satisfactory lubricant for the high temperatures encountered.

Pipe Conduit Forms Rack For Blueprints

ENGINEERING

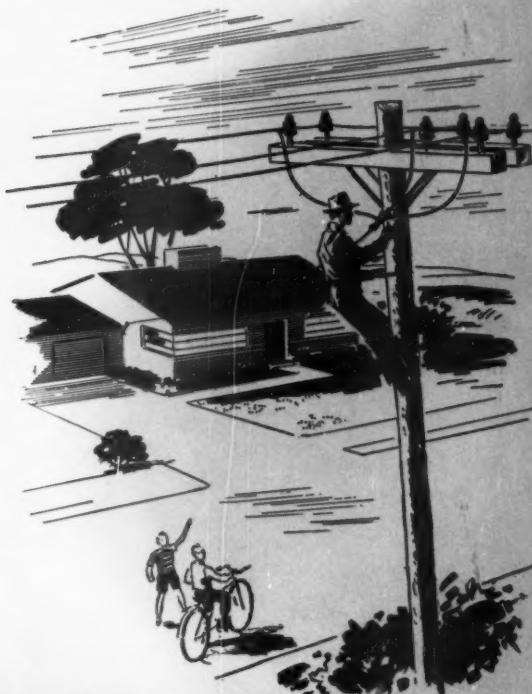
A rack for holding sets of plans and blueprints flat against the wall is a useful method picked up on a visit to S. I. (Bud) Jaggar and A. A. Tobey at the Jaggar-Sroufe Company in Portland, Oregon. The rack is supported by a vertical pipe held securely to the floor and ceiling by means of standard flanges threaded to the pipe ends and screwed to the two surfaces. Over this vertical pipe, 19 couplings have been placed. The couplings are



CONDUIT AND COUPLINGS make up this rack for blueprints that lie flat against the wall when not in use. Bottom coupling is drilled to take a hold bolt. Other couplings have rods welded to them for supporting sets of prints. Idea was dreamed up by Jaggar-Sroufe Company, Portland, Oregon.

For service entrance cables with extra dependability...

Today it's Roebling!

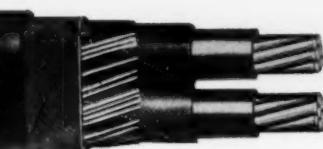


There's a Roebling electrical wire or cable—more than 60 standard types—for practically every transmission, distribution and service requirement. Descriptive literature about any or all types will be sent you on request.

TO CARRY CURRENT direct from pole to service equipment, there's a Roebling Service Entrance Cable to meet each particular requirement with top dependability and economy... above-ground cables requiring no conduit protection...underground cables with special rubber or armored jackets...a self-supporting drop cable for overhead connection between pole and house.

Each type and style of Roebling Service Entrance Cable is made in the constructions adapted to its own special range of service. From copper wires to outer jackets, all components of these cables are made in Roebling's own plants where modern manufacturing techniques and equipment assure the highest standards of quality.

Have your nearest Roebling distributor help choose the best cable for any given application. John A. Roebling's Sons Company, Trenton 2, New Jersey.



ROEBLING

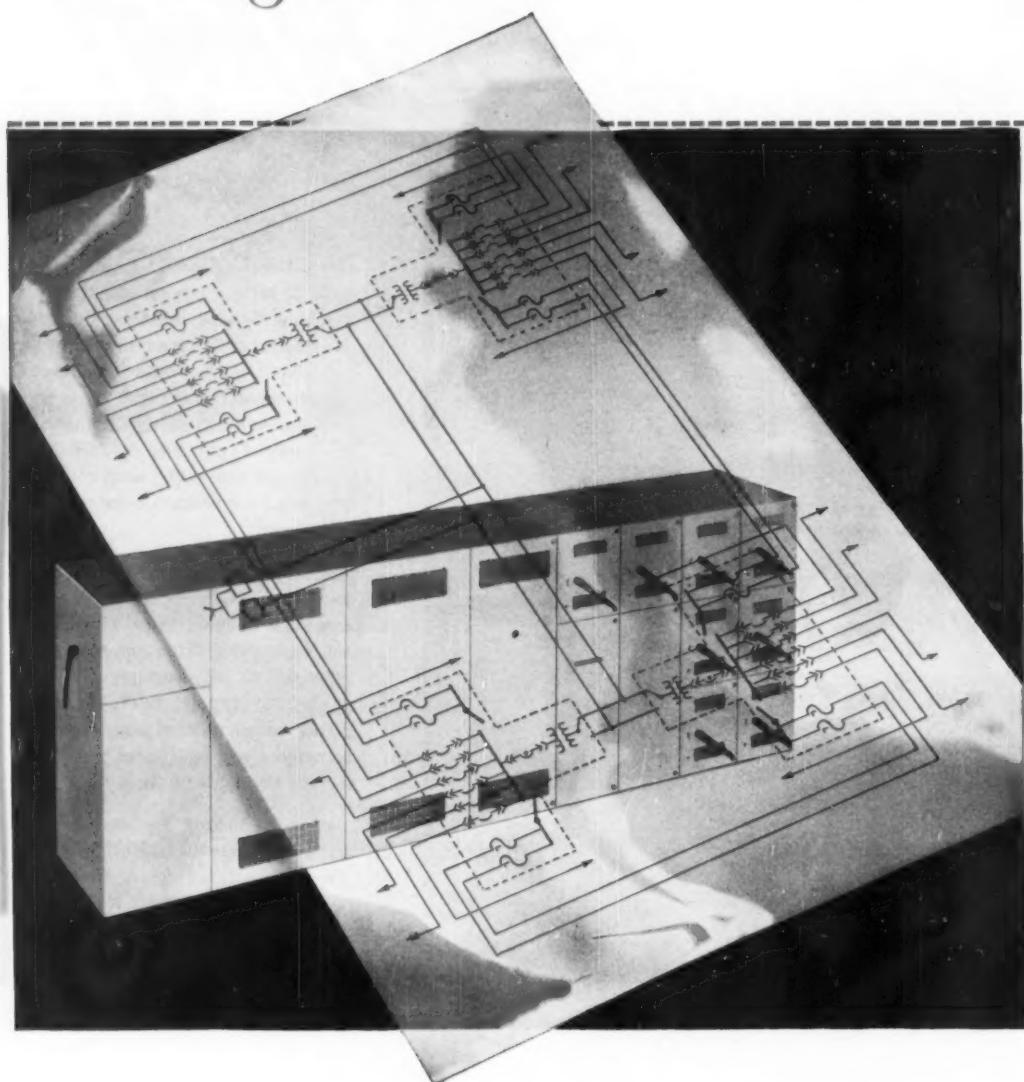
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216 S. Alameda St. • New York, 19 Rector St.
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Westinghouse



PRIMARY SELECTIVE NETWORK SYSTEM

This modern distribution system provides maximum flexibility to meet changing load conditions. It provides very reliable service with very good regulation and efficiency. By sacrificing these characteristics to some degree it is possible to use other systems whose initial investment is less. To evaluate the system most desirable for your plant, consult your Westinghouse Representative.



Visualize

your power problem this way

Any old way of running wires to your equipment may work . . . but what about efficient, profitable operation?

A modern electrical distribution system can make electrical power do more of *your kind* of work. But again, just any of the modern systems won't do, because there is no all-purpose system to balance all factors. *That's why it's imperative that your system be planned to meet your specific needs.*

Power centers provide the simplest way—the low-cost way—of attaining the system you require.

Westinghouse Indoor Dry-Type Power Centers give you these advantages:

THEY'RE MORE ECONOMICAL—because they eliminate the need for costly vaults and can be located near center of load . . . resulting in shorter secondaries, lower line losses, better regulation.

THEY COST LESS TO MAINTAIN—no liquids to test, recondition or replace . . . no gaskets, valves or gauges. All parts are readily accessible.

THEY'RE SAFER—fire and explosion-proof, they have no exposed live parts. Each breaker is enclosed in an individual compartment. Positive interlocking prevents false breaker operation.

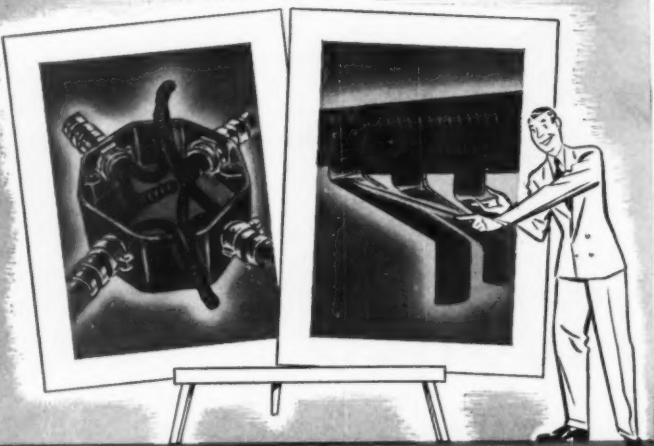
Your Westinghouse Representative will be glad to discuss your system problems with you. He is prepared to offer complete system information, with advantages of each carefully weighed.

Ask him for Booklet B-4045, "Industrial Power Distribution Systems" and B-4162, "Power Centers by Westinghouse". Or write Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania.

J-60732



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US ACCURATE FRICTION AND RUBBER TAPES

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On big jobs or small there's no substitute for the double protection of Accurate rubber and friction tape. Strong, stretchy live rubber to provide an impervious dielectric covering and tough, hard sticking friction tape for permanent mechanical protection. Both types are easy to apply—extra pliable for tight, neat wraps over pigtailed and irregular surfaces. Try Accurate Tape on your next job—you'll do a better job and you'll do it in less time.



ACCURATE FRICTION TAPE
Made of high grade rubber, finest cotton base. Provides maximum mechanical protection. Available standard and A.S.T.M. grades.



ACCURATE RUBBER TAPE
Features high elasticity, excellent cohesion, high dielectric strength, super aging qualities. In standard and A.S.T.M.-A.R.R. grades.



NEW ILLUSTRATED CATALOG
Complete specifications and data on Accurate Tapes. Call or write for your copy to Accurate Manufacturing Company, Garfield, New Jersey.

IF IT'S TAPE... IT WILL PAY YOU TO MAKE SURE

IT'S
ACCURATE TAPE



sufficiently oversized so that they rotate around the pipe freely. The bottom coupling is tapped and bolted firmly to the vertical pipe, while the remaining 18 couplings support hanger rods which have been welded to the various couplings.

In practice, sets of blueprints are slipped over these hanger rods and the entire collection is pushed flat against the wall when not in use. Conversely, it is a simple matter to spot the plan required, swing the proper hanger out from the wall and remove the prints.

Steel Chest Serves As Storage Bin

CONSTRUCTION

On many electrical construction or service jobs, it is not feasible to establish a local storeroom or tool shop on the job or to send a truck out to remain idle through the day. However, when some means of storage is not provided, materials and tools frequently become misplaced or lost.

Vaughan Electric Service of Los Angeles, California, has solved the problem by constructing heavy steel chests, heavy enough to prevent ready lifting or proloining and large enough to contain sufficient material for the average small job. The chests are painted a distinctive color, so the property of Vaughan can be quickly spotted. Heavy welded handles make it possible to run a chain through handles and around a fixed anchor point if it is desirable to do so. The boxes can therefore be left on small jobs with comparative safety, the electrician has a place for storing his materials and tools, and the chests can be picked up and delivered by a company truck at the beginning and end of a job. A movable tray in the top of the



ELECTRICAL materials, small tools and accessories are stored safely on the job in heavy steel chests which are transported to the jobsite by truck and picked up after the work has been completed.

In Lone Star's Reception Room

ten 33½" x 41" panels of white translucent PLEXIGLAS are mounted 12' below twenty 30-watt, 36" fluorescent lamps, spaced on 16" centers. Average illumination: 55 foot candles. Design and installation by The Frink Corp., Long Island City, N. Y. Architects: Kenneth H. Rippen Inc., New York City. Lighting Consultant: E. B. Silverman, Smith & Silverman, New York City.

Skylighted Office? No!
It's a
PLEXIGLAS
Luminous Fixture

*Man-made daylight—soft, even, glare-free—is a functional and decorative feature of Lone Star Cement Company's new offices in New York City. In nearly every room, PLEXIGLAS Luminous Ceilings diffuse light so perfectly that a *luminous environment* is created, easy on the eyes and nerves.*

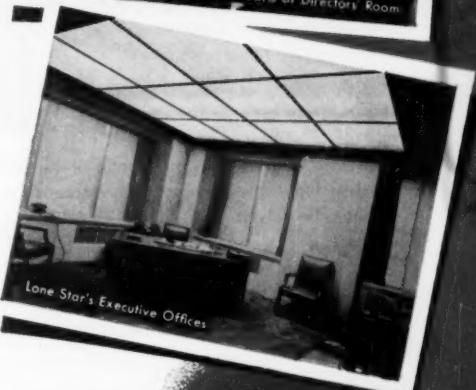
PLEXIGLAS simplifies the design, installation and maintenance of other lighting fixtures, too. Because this acrylic plastic is easily cut, shaped and fabricated, it adapts readily to coffer, cove or trough lighting, completely enclosed units, wall or overhead lighting of all kinds. Lightness and strength make it easy and inexpensive to ship and erect. Resistance to breakage and discoloration cuts maintenance costs to a minimum.

Get Full Details Today. Free information on PLEXIGLAS Quality Lighting for offices, homes, stores, drafting rooms, public buildings, yours for the asking. Send for our new brochure, No. 77, "As Light as Day the PLEXIGLAS Way," and tell us about your lighting problem. The counsel of our Design and Fabrication Laboratory Staff is yours without obligation.

PLEXIGLAS is a trade-mark, Reg. U. S. Pat. Off., and in principal foreign countries.
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Lone Star's Board of Directors' Room



Lone Star's Executive Offices

CHEMISTS

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SPUN ALUMINUM LOUVRES

for distinctive modern design.

HEATPROOF ALZAK FINISH**

is not discolored or affected by lamp heat.

DUSTLESS OPEN BOTTOM

minimizes cleaning — dirt falls through.

SILVERBOWL LAMP

provides built-in reflector. Peak efficiency is automatically restored; when lamp is replaced, you have a new reflector.



The functional simplicity and beauty of the GUTH SEELUX make it the standout among indirect incandescent luminaires. Compare these SEELUX specs with any similar fixtures:

Have you our Bulletin 864-A with full details on the SEELUX, SEELUX Plus and other fine GUTH Incandescent Indirects? It's yours for the asking from

Guth
LIGHTING

THE EDWIN F. GUTH COMPANY / ST. LOUIS 3, MISSOURI

Leaders in Lighting since 1902.

* ® and Patents Pending

** ® and Patented, Aluminum Co. of America

chest is divided for storing small items, and two small channels fastened to the inside of the lid provides space for storing hack saw blades. Blades are prevented from slipping out of these channels by means of a short piece of cellophane tape. A complete inventory is also placed on the inside lid, making it possible to quickly note deficiencies. Also, for rapid identification, each chest is clearly numbered.

Template Speeds Conduit Bending

WIRING

When conduit is bent for upsweeps, turn downs or changes in direction, exact dimensions must be maintained if the ends are to be properly positioned. One foolproof method to insure bends being started at the exact position is to use a template or rod marked by circular notches at the proper distance from the end. The rod is so slender that it can be placed alongside of the conduit, held firmly by the operator of the bending machine, and simultaneously moved with the conduit until the proper notch lines up with the initial point of bend. On large jobs where many bends are made for the same radius and upsweep, this template is a definite aid in speeding the work and insuring accuracy. Such a method was employed with success on the \$60,000,000 Metropolitan Life Insurance Company's huge housing project in Los Angeles, California, which was electrically handled by the California Electric Construction Company.

On this job, outstanding because of its size, it was necessary to make 108,000 right-angle conduit bends.

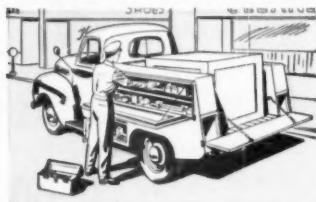


NOTCHED ROD is held alongside conduit, insuring proper length of completed bend. This is handy aid when many bends of the same length are being formed.

America's most popular service body used in every state in every service industry



Absolutely weathertight compartment doors • Built-in trays, adjustable shelves and parts bins for orderly storage • Horizontal doors, when open give working surface on the job.



Fully enclosed wheel-housings provide added protection and rigidity • New recessed, positive action handles with flush locks • 48½" inside width, more load space than a pick-up



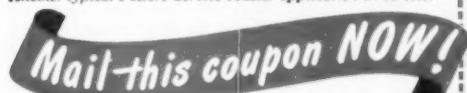
LOWER YOUR SERVICE COSTS WITH ONE-TRIP SERVICE!

Lost time is lost profit . . . so take your shop to the job in a Powers Service-Master body. The Service-Master is completely compartmentized and efficiently organized . . . increases the output of even your best service men. Take all your tools, parts, and supplies with you . . . speed up calls, reduce return trips. Electrically welded body is of all steel construction . . . comes completely assembled in one unit. Built to last many years . . . remountable on new chassis with only six body bolts. Cut down your service costs, increase your profits with Powers Service Master!

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Please send me literature and further information about the POWERS "Service-Master" All Purpose Service Body.

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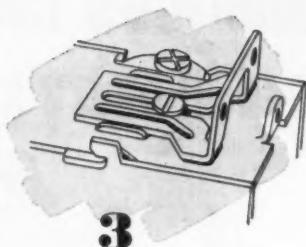
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EASY METHOD OF LEVELING BOX. Four contact points — in place of the usual three — make the job of leveling the box against the studding a sure, easy one. Tilting or rocking of the box is eliminated — the job is speeded.



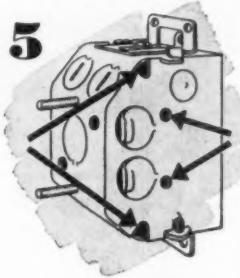
NEW LOCKING MECHANISM. Wedging action of the Levelock's new locking mechanism securely locks the side plates — even when subjected to extra severe abuse they remain tightly in position.



NEW EXTRA-STURDY, SINGLE-SCREW EAR. Adjustable from slightly above to $\frac{1}{8}$ -inch below the edge of the box. Sturdy ribbed design and heavy bridge across ear provide increased strength.



NEW EXTRA SIDE PRYOUTS. For out-of-the-ordinary installations. All pryouts are easily removed by a simple twist of a screwdriver blade.



EXTRA SET OF NAIL HOLES. Extra set of nail holes through side plates permits speedy gang mounting. In addition, nail-through holes are also provided for mounting a single box direct to studding — just drive home two 10d nails and you're ready to wire.

Get All Five time-saving features

with the new General Electric Levelock* Switch Box

Once you've used the new General Electric Levelock switch box, you'll really appreciate the way it saves your time and temper. Whether scribing lath or wallboard cutouts — or abusing the box during installation — the side plates remain tightly in position. Levelock's ingenious construction is the answer.

You'll like the ease of installation afforded by the Levelock's

nail-through feature and the extra leveling projections.

General Electric Levelock boxes are easily gangable with old-type units for use on modernization jobs. They are available in all of the most popular types. We're sure you'll welcome their many time-saving features. Get them from your local G-E distributor and try them on your next job. Section

C14-1018, Construction Materials Department, General Electric Company, Bridgeport 2, Connecticut.

Listed By Underwriters' Laboratories, Inc.

*Here's the
Levelock
story . . .

***LEVELOCK** — Refers to two of the outstanding features of the new General Electric switch box. Level, because the Levelock assures steady, even mounting to the studding. Lock, because the new locking mechanism creates a wedging action that locks the side plates tightly in position.

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The Editor,
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330 West 42nd St.
New York 18, N. Y.

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41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80
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Electrical Construction and Maintenance is written for you by a large staff of editors and consultants, each an authority on some phase of the business. They will be glad to give you expert advice and answers to your questions.

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To secure further information on new product or new catalog and bulletin items listed elsewhere in this section, use the card on the other side.

Product News



Soldering Gun

(1)

Dual spotlights to eliminate shadows, and over/under terminals to brace tip and improve visibility, are features of the new light-duty soldering gun recently announced. It is recommended for use by electricians, radio and TV technicians, automotive mechanics, laboratory workers, hobbyists, etc. It features dual heat (100/135 watts) for all light and delicate soldering—5-second heating to save time and current—trigger-switch control which adjusts heat to work and eliminates need of unplugging gun between jobs—and chisel-shaped Weller tip.

Weller Electric Corp., Easton, Pa.



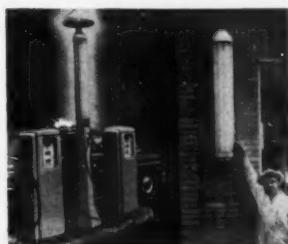
Lighting Fixtures

(2)

A new line of Swivelite display fixtures for accent lighting has been announced. They incorporate a new "Adapt-A-Unit" principle in design and construction, which means that all basic parts are completely interchangeable. A double-ball swivel provides free-floating 360° horizontal and 170° vertical directional focus. Fixture can be flexed to any position by a fingertip touch and stays put at any angle without the use of set screws or wing nuts. Satin-aluminum finish is protected by Amplex "permacoat". Improved ventilating ports carry off excess heat away from lamp socket. Porcelain shell of swivel socket is removable to allow

addition of either standard or midget hood units. Louverclips are available for hood units. They can be used either with or without color filters. Standard hoods accommodate R40, RE40, PAR 38 reflecto lamps; R30 reflector lamps are used with midget hoods.

Amplex Corporation, 111 Water Street, Brooklyn 1, N. Y.



OUTDOOR FLUORESCENT post and wall lights have been announced. Post-Lite is equipped with hinged frame for maintenance and has a 2 inch pipe mounting top and bottom with removable top cap. Unit is 62 inches over all, 9 inches in diameter, and has six 40-watt instant start fluorescent tubes. Wall-Lite has an overall height of 58 inches, is 10 inches in diameter and has four 40-watt tubes. It has three knockouts for electrical service, four expansion shields and bolts for mounting and is equipped with a corrosion proof steel back. Recommended for service stations, hotels, theatres, used car lots, highways, public building entrances, etc. Manufactured by Great Northern Mfg. Corp., 4221 Harrison Street, Chicago 24, Ill.

Chuck

(4)

A new nipple chuck for threading of short nipples has been announced. It is of simple design which fits any threading machine or vise without special tools, parts or adjustments. It requires no adjusting or changing of stop plug which is an integral part of nipple chuck, and is always automatically in position for use. Pipe adaptors are made for $\frac{1}{8}$, $\frac{1}{4}$, $\frac{3}{8}$, $\frac{1}{2}$, 1, $1\frac{1}{4}$ and $1\frac{1}{2}$ inch pipe; nipple chuck holds 2 inch pipe. Device is made also for British standard pipe thread.

The Ridge Tool Company, Elyria, Ohio.



Connector

(5)

A new $\frac{1}{2}$ inch all-steel 90° angle connector with new locknut has been announced. No. 321 connector is for armored cable sizes 14-2 and 3 through 10-2, and for $\frac{1}{2}$ inch flexible conduit. Locknut has been improved by case hardening. The Tite-Bite clip with its two legs anchors cable firmly. One screw tightens clip and locks connector together. It protects the insulation on type T or TW wire. Listed by Underwriters' Laboratories.

The Thomas & Betts Co., Inc., Elizabeth, 1, N. J.



Radiant Heater

(6)

A new portable, radiant heater has been added to this line. It is equipped with two radiant heater elements formed of nickel-chrome alloy wire coiled on round ceramic rods, placed in front of a chrome-plated Heat-Ray reflector having an area of 167 square inches. It distributes heat over an area of 7 feet wide at a distance of 3 feet from heater. It has a capacity of 4450 Btu per hour and operates on 115 volts ac or dc.

Emerson Electric Mfg. Co., St. Louis 21, Mo.



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**Floodlight**

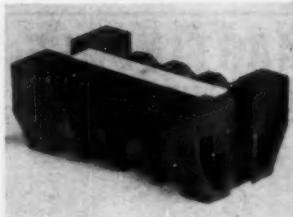
(7)

A 250-watt heavy duty floodlight, known as type CA-10, has been added to this line. It is designed for applications requiring a rugged unit of low wattage that produces a relatively narrow beam spread. Typical applications include construction machinery, sign lighting and lighting of small monuments. Body and door frame are cast in one piece of silicon aluminum. Graphitized asbestos gaskets are used to seal joints between lens and door frame, and between door frame and body. Lens is of pressed heat-resisting glass, and available in a choice of plain, diffusing or spread-type glass. Medium screw socket is mounted on a lamp-focusing mechanism that provides for adjustment of light center of lamp on horizontal axis of reflector.

*Westinghouse Electric Corporation,
Pittsburgh 30, Pa.*

contrast; all-porcelain enamel channels for locations with excessive moisture; and longitudinal shields, available as optional equipment on all two-lamp units to provide an additional shielding angle of 14°. The 72 and 96 inch systems are designed with two-piece reflectors, which are kept in alignment by means of a positive alignment clip and rigid overlapping construction. This construction facilitates maintenance by making reflector removal for cleaning and servicing a job for one man.

*Benjamin Electric Mfg. Co., Des
Plaines, Ill.*



ready wire identification. Two connector types are available, a washer-head screw type and a pressure type. Optional product features offered are short-circuiting strips for current-transformer secondary circuits and hinged covers with knurled-head captive holding screws.

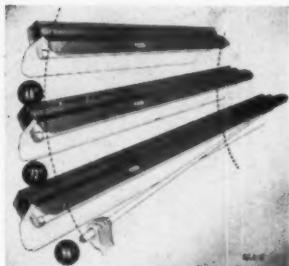
General Electric Company, Schenectady 5, N. Y.

**Cable Reel**

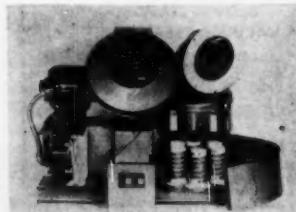
(9)

A new reelift handling large cable reels up to 2000 lbs. has been announced. Slip the axle through the hole in the reel, slide frame handles through axle fittings and lift reel with an easy motion. When mounted, reel revolves easily on axle and cannot get away or upset. Broken flanges cause no trouble. Model RL 25 handles all reels up to 36 inch diameter and 25 inch overall width. Model RL 31 up to 42 inch diameter and 31 inch overall width.

*HyKon Manufacturing Co., 163 E.
State St., Alliance, Ohio*

**Fluorescent Lighting Units** (8)

New "Magna-Flo" fluorescent lighting units with "Springlox" lampholders, especially designed for the new T-12 slimline lamps have been announced. "Magna-Flo" systems are available for 96, 72 and 48 inch lamps with two or three-lamp lampholders and for mounting as continuous line-lighting or individual units. Other developments include open-end porcelain-enamelled reflectors bearing RLM label or closed-end reflectors; diffuser reflectors which have apertures to direct 5% of light upward to cut brightness

**Electric Heater**

(11)

A forced air, heavy-duty electric heater has been announced. Unit is approximately two feet square, weighs 70 pounds, and will fit anywhere, closet, attic, floor, etc. It operates on 220 volts and uses 13,100 watts in developing equivalent of 45,000 Btu's. Unit is available in two models. Speed-heater model 14E is a suspended unit and has adjustable blower which can be set in 22° steps to discharge air at floor, or wall, or vertically at ceiling. Model 1450E is a floor or suspended console unit that weighs 115 pounds and stands 34 inches tall including 9-inch legs. For suspended mounting, console may be hung on wall using factory-designed brackets, with mounting hole centers of brackets spaced 32 inches apart so as to fasten to studs. A high temperature limit switch provided to shut off both element and motor current in case of motor trouble, and a factory-designed switch is used. A remote 24-volt type of thermostat in combination with switch makes possible automatic operation. Blower moves 260 cubic feet of air at a speed of 1300 feet per minute.

*Kilbury Mfg. Co., 14529 Hawthorne
Blvd., Lawndale, Calif.*

Terminal Board

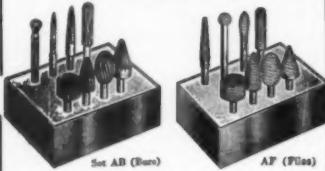
(10)

A new and improved Type EB-5 terminal board for switchboards, control apparatus and other similar uses has been introduced. It is rated 600 volts, 30 amperes and available in four, six, eight and twelve terminal units. Each terminal will accommodate wire sizes AWG 18 to 10 inclusive. A white plastic marking strip on board provides

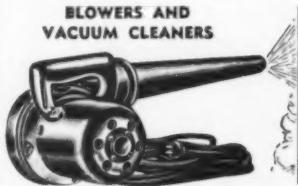
MARTINDALE MOTOR DRIVEN FLEXIBLE SHAFT GRINDERS



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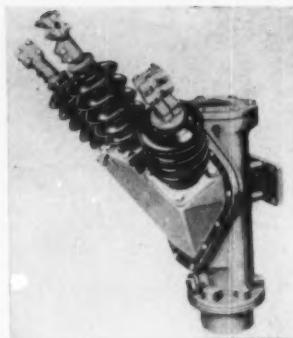


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Weigh less than $\frac{1}{2}$ ounce.



Write for 64-page Catalog describing these
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MARTINDALE ELECTRIC CO.
1309 Hird Ave. Cleveland 7, Ohio



Pothead

(12)

A new Type "TA" Shape "A" 3 conductor pole top pothead has been announced. The forward slope of porcelains provides proper clearance from live capnut terminals to ground. No bends in conduit risers are needed to get necessary clearance when pothead is mounted on pole tops or grounded structures. It can be disassembled to permit cable connection. Individual porcelains and front plate are removable units. Large opening in front of body permits training of cable conductors and arranging them in proper phase relationship. Before assembling the lid with porcelains, conductors are cut to correct length, connectors attached and stress relief cones applied. After assembly, a special reservoir is attached to pothead and heated compound is poured directly from pail until pothead and reservoir are filled.

G & W Electric Specialty Company,
7780 Dante Avenue, Chicago 19, Ill.

from unit. It automatically supplies the right amount of power at any time for any station in an intercom system, and is especially effective in factory, school or large industrial establishments where there is a high noise level, or where remote installations complicate intercommunication. Whether one, two, ten or 20 stations are called, each receives its predetermined volume up to the full ten watts of each unit.

Talk-A-Phone Co., 1512 S. Pulaski Road, Chicago, Ill.

Electronic Air Cleaner (14)

A new Precipitron electronic air cleaner, constructed for upward or downward air flow to conserve floor space and simplify maintenance, is now available. Designed to remove dust, dirt, smoke, soot, and other airborne solids from normal air, it charges the solid particles positively, then passes the air through a set of alternately charged collector plates where the solids are removed by electrostatic attraction. The vertical air flow precipitron finds typical use in heating and air conditioning systems, and for oil-mist collection. It operates on 115 volts, single phase, 50 or 60 cycles.

Westinghouse Electric Corporation,
Sturtevant Division, 200 Readville Street, Hyde Park, Boston 36, Mass.

(15)



PORTABLE LIGHTING unit designed as an all-purpose general utility light has been developed. It is weather-proof, UL-approved and self-contained for all applications of floodlighting, spotlighting, sign lighting, and protective building and yard lighting, as well as rural and suburban home lighting. Unit is made of non-corrosive, non-rusting cast aluminum and consists of lampholder with three mounting accessories providing interchangeable mounting positions on posts, walls, benches, floors, sides of building, in ground or on junction boxes. Lampholder adjusts to any direction. Manufactured by Stone Manufacturing Company, Elizabeth 4, N. J.

Intercommunication (13)

Designed to overcome high noise levels and solve unusual intercommunications problems, Redi-Power, a self-compensating power control unit has been introduced. It is available as optional equipment in the Talk-A-Phone Chief line. It provides power to reply from considerable distances



Switch

(16)

A new double-pole, single-throw toggle switch has been announced. Listed as Model 2160A, switch body measures $1\frac{1}{8}$ inches by $1\frac{1}{8}$ inches by 1 inch and working parts are enclosed. Switch snaps into hole where spring clips hold it in place. Standard clips are designed to give a snug grip on panels ranging in thickness from .025 to .100 inches. Shoulders provide a generous overlap to compensate for wide tolerances in finish dimensions of installation holes. Switch is rated at 15 and 20 amp, 125 volt; 10 amp, 250 volt; ac and up to $\frac{1}{2}$ hp at 250 volt ac. Plastic body is standard in brown, black and white. Designed for use in motor and heater circuits in portable ungrounded appliances.

Hart Manufacturing Co., 110 Bartholomew Ave., Hartford, Conn.



Fixture Hangers

(17)

Announcement has been made of a new Model AL-4660 disconnecting and lowering lighting fixture hanger which provides versatility of a 4-pole unit for a wide range of outdoor lighting applications. Constructed of corrosion resistant aluminum alloys, it permits suspension of pairs of lighting units, or single units requiring 2 or 3 circuits,

RAWLPLUG

is the trade name of
ONLY the ORIGINAL and GENUINE!
All others are imitations*

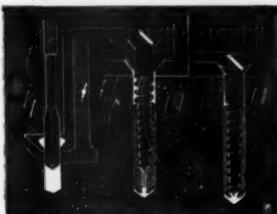
The word "RAWLPLUG" used in connection with *Jute Fibre Screw Anchors* is exclusively the property of The Rawlplug Company, Inc. For forty years it has been secured to them by common law and by trade mark registry. It is the corporate and trade name of the company and specific product of their manufacture.



**Substitutes*

CAN PROVE DANGEROUS!

Buy—Stock—Sell and Use *Only* the Original and Genuine RAWLPLUGS... There are many imitations... so look for the trade mark "Rawlplug" on the Blue Box.



RAWLPLUG eliminates extra troublesome spotting or layout work... with RAWLPLUG just drill through the hole in the fixture to be fastened, insert the plug and drive the screw home.

RAWLPLUG Holds Better... because the flexible jute fibre construction permits complete conformation to all irregularities the entire length of the hole drilled.

RAWLPLUG Lasts Longer... because of the vital 100% chemical impregnation against any form of deterioration.

RAWLPLUG May Be Used In... Plaster—Brick—Concrete—Cinder Block—Stone—Hollow Tile—Plastics—and a very long list of materials for various purposes too long for space to permit listing...

RAWLPLUG Weighs Less, Costs Less, and Holds More... There is a size and length RAWLPLUG for every wood screw...

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"IF YOU DON'T USE RAWLPLUGS... THERE'S A SCREW LOOSE SOMEWHERE"
12x12 For further information write Dept. E

The Rawlplug Company, Inc.

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THERE ARE RAWLPLUGS,
EXPANSION BOLTS, SCREW ANCHORS AND MASONRY DRILLS FOR EVERY NEED.
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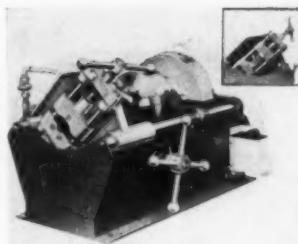
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Other GREENLEE timesaving tools for industry:
Hand Benders for Bending • Hydraulic Pipe Pushers
Knockout Tools • Auger Bits and Drills • Spiral
Screw Drivers • Chisels and Gouges • And many
others. Greenlee Tool Co., 1750 Columbia Ave.,
Rockford, Ill.

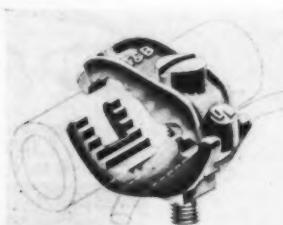
from a single hanger. Individual control of each circuit is provided, and hanger can be used in any combination of circuits within its rated capacity, such as two circuits 3-wire, two circuits of 2 wires each, or three circuits of 4 wires each with a common return. It is recommended for suspending separately controlled floodlights which may be of different sizes or types, clusters of prefocused spotlights, pairs of railroad grade crossing or underpass flasher signals, 4-wire traffic lights, and for applications in industrial plant yards, municipal recreation areas, construction projects, swimming pools, etc. Underwriters' approved and rated 15 amperes 115 volts and 7.5 amperes 230 volts, ac, on each circuit.

The Thompson Electric Company,
1101-57 Power Ave., Cleveland 14,
Ohio



square-end cut without burr. Blades are fed through a scroll by a small hand wheel, and may be resharpened many times. A 12 tooth cone type fluted reamer on arm swings into position for reaming. Motor is $\frac{1}{2}$ hp, heavy duty, 115 volt Universal type, dc or ac, any cycle, ball bearing, reversible.

Toledo Pipe Threading Machine Co.,
Toledo, Ohio.



Ground Clamps

(18)

Two new grounding clamps have been announced. They are listed by Underwriters' Laboratories for use on copper water tube, $\frac{1}{2}$ inch to $\frac{3}{4}$ inch in residential wiring systems. Constructed of bronze, special design prevents them from crushing copper tube. Also approved for $\frac{1}{2}$ inch to $\frac{3}{4}$ inch copper brass, or iron water pipe and $\frac{1}{2}$ inch to $\frac{3}{4}$ inch ground rod and pipe. No. 3847 is for armored grounding wire No. 4, No. 5 and No. 8. A set screw holds armor, while clamp itself anchors ground wire. No. 3846 is for No. 4 and No. 6 bare grounding wire.

The Thomas & Betts Co., Inc.,
Elizabeth 1, N. J.

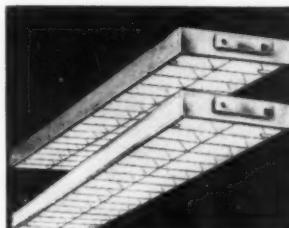
Terminal Lug

(20)

The new "Termend" solderless lug can be installed on all wire sizes from No. 16 to No. 8 AWG with single crimping tool. Tool used for installation is same as used for installing Buchanan splice caps for pigtail connections. "Termends" are available in ring, spade and locking spade tongue styles. They are approved by both Underwriter's Laboratories, Inc., and Canadian Standards Association.

Buchanan Electrical Products Corporation, 1290 Central Ave., Hillside, N. J.

(21)



THIN-PANEL LUMINAIRES have been announced. In the series are four-foot and eight-foot, two-lamp and four-lamp, totally direct or direct-indirect units, glass or metal side panels, and standard fluorescent or slimline lamps. They are for surface or pendant mounting individually or in continuous lines. For Circline or PAR-38 reflector lamps, 12-inch and 16-inch square units are available. Used independently or coupled in various combinations of the four and eight foot units, they add to the flexibility of the line. Manufactured by Garden City Plating & Mfg. Co., 1750 North Ashland Ave., Chicago 22, Ill.

Wheel Cut-Off

(19)

A choice of either wheel and roller cut-off or knife cut-off is now offered on the No. 999 super model 2 inch power pipe machine. With the wheel cut-off, the cutter head is equipped with two rollers and one cutter wheel which is self-centering and fed with hand wheel. If a knife cut-off is preferred, machine is furnished with four cutter knives which leave a straight

Designed for Contractors by Wakefield



The Hook-On Stem

...the quickest device ever designed for hanging fixtures

Screw in the stem and canopy assembly; then just slip the flared end of the stem into the bayonet slot of the pre-installed strap on the ceiling. Tighten the set-screw. In seconds, the fixture is hung. Then, with two self-tapping screws attach the end to the continuous run. Designed for quick one-man installation, Wakefield

units save time, save labor and save your customer money on every job. And each step is just as easy—as we'll show you in future ads.

Wide-awake contractors don't say, "Hang the expense!" They say, "Hang Wakefield!"

The F. W. Wakefield Brass Company • Vermilion, Ohio

Wakefield
Over-ALL Lighting



GRENADIER

STAR



COMMODORE



WAKEFIELD CEILING

...THIS SUPER MARKET



A DREADNAUGHT INSTALLATION

103 DR2-96-430 and 9 DR2-72-430 Magna-Lite Luminaires spaced on 8' centers and flush-mounted on 14' ceiling provide 80 foot candles at 75 burning hours in this 110' x 60' market.

... AND THIS OFFICE



A WHITE KNIGHT INSTALLATION

75 foot candles were provided at 500 burning hours by WK4-96-430 Magna-Lite Luminaires spaced on 10' centers and flush-mounted on 9' ceiling.

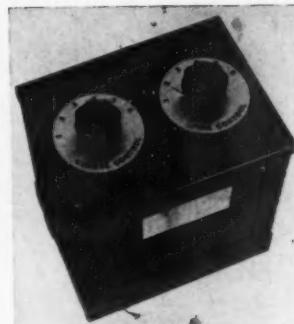
ARE TYPICAL

of the quality of light produced by White Knight & Dreadnaught Luminaires. Lighting such as this, increases efficiency and employee morale in the office; increases sales in the store. Let our representative show you how you can benefit with a lighting installation planned for your needs. Write for detailed Bulletin White Knight WK 2-4 for Office and Store Lighting and Bulletin Dreadnaught DR 2 for commercial establishments.



Manufacturers of Fluorescent Lighting Fixtures

306-308 CHERRY STREET • PHILADELPHIA 6, PA.

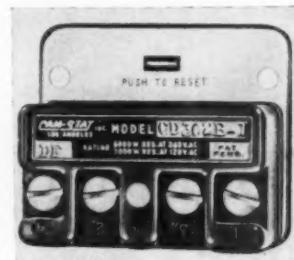


Transformers

(22)

New tap changing transformers for furnace temperature control and general variable voltage use have been announced. They were developed to replace rheostats and input control devices to afford more accurate control of electric furnace temperatures. In addition to furnace temperature regulation transformers can be used in laboratories wherever a wide range of voltages is required. The 750, 1700 and 3500 watt transformers provide 36 equal steps of output voltage control and may be either wall or bench mounted. The 5000 watt model provides 72 steps of output voltage control and is shelf mounted. All transformers operate from a 60 cycle supply. Asbestos heater cord and plugs are furnished on the 750 and 1700 watt models. The 3500 and 5000 watt models are designed for installation with rigid or flexible conduit.

Hevi Duty Electric Company, Milwaukee 1, Wis.



Control Switch

(23)

A new manual reset overheat control switch, which provides positive protection against temperatures in excess of those for which the equipment is set, has been developed. Features of unit are: cut-out temperature at any level from 160° to 200° F in steps of 5° F; rating of 6,000 watts resistance load at 240 VAC; large, silver contacts; no vanishing contact pressure;

hammer action-clean break operation; double-pole, single-throw switching action. Unit can be supplied integrally mounted to single-pole, double-throw water heater thermostat. It can also be supplied as a separate control switch for equipment which is already in service. Carries U. L. approval.

Cam-Stat Incorporated, 2310 S. La Cienega Blvd., Los Angeles 34, Calif.



Ground Tester

(24)

A new CVM type of Megger ground tester for measuring resistance to earth of ground connections has been introduced. This set has its own generator for supplying test current, is always ready for service without dependence on battery or other supply. Terminal arrangement employs two switches which short-circuit terminals for 2, 3 and 4 terminal tests. Each instrument has two scales, permitting open, well-proportioned markings. Two ranges are available, 0 to 40 and 0 to 200 ohms; 0 to 100 and 0 to 500 ohms.

James G. Biddle Co., 1316 Arch St., Philadelphia 7, Pa.

Induction Motors

(25)

Announcement has been made of the re-design of this line of large, bracket-bearing, squirrel-cage induction motors of four or more poles to provide more protection and greater accessibility. Capsule-type sleeve bearings are standard. Split, cast-iron bearing capsule or housing has a machined flange for bolting to bearing bracket. This permits removal of upper half of bracket for inspection or cleaning without exposing inside of bearing. Only openings in bearing brackets are in air intakes near bottom. This construction, plus the use of louvered panels in stator air-discharge openings, makes standard design drip-proof.

Allis-Chalmers Mfg. Co., Milwaukee, Wts.

KEEP
YOUR
EYE
ON
QUALITY

No. 5001
Flush Tumbler Switch, 10A-125V-T, SA-250V. Features high grade bronze double wiping contacts with snuffer action, large binding screws with ample wiring room for splices, including #10 conductor cable. No. 5003 same in 3-W.

No. 260 Line
Flush Tumbler Switch, 10A-125V-T, SA-250V. Heavy duty Bakelite. Features a handle framed in a pod that fits flush with wall plate opening; terminal screws at opposite ends ample for No. 10 wire and wide break-off type plaster ears. In Brown and Ivory. No. 261 same in 3-W.

No. 250 Line
Heavy Duty Flush Tumbler Switch, 10A-125V-T, SA-250V. Features a Bakelite cup and a handle framed in a pod that fits flush with wall plate; strap full width of switch (can be used for plaster mounting). No. 251 same in 3-W.

No. 1130 Line
Flush Tumbler Switch, 10A-125V, SA-250V. A completely dust-proof compact switch mechanism in Bakelite cap. Features wide break-off type plaster ears, and terminal screws at opposite ends ample for No. 10 wire. Permanently assembled to prevent loosening. No. 1131 same in 3-W.

A FINE LINE OF PERFORMERS

On installations throughout the country, Leviton devices have met the test of time for durability and performance. From such experience comes confidence.

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at all leading distributors

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NEW-

A valuable handbook on your D-C equipment

Dusenberry's



D-C MOTOR MANUAL

can help you select and
maintain this equip-
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- This new book provides the information which years of experience have shown to be most useful to the man responsible for the installation and maintenance of modern d-c motor generators AND ELECTRONIC CONTROL EQUIPMENT.
- It explains in clear practical terms how each part and circuit works; what type of motor is most efficient and economical under certain operating conditions; the latest methods of installing and servicing each part; how to reconnect motors; how to test for power and losses.
- It contains FULL INFORMATION ON BRUSHES—how to select replacements; how to be sure of proper installation.
- ALL THE LATEST CONTROL EQUIPMENT is fully explained with complete instruction in the operation and maintenance of the Rototrol, Ampidyne, Maxipred, Mo-Trol, Thy-Mo-Trol systems; rectifier tubes, etc.
- More than 7 pages of MAINTENANCE CHARTS give the symptoms and causes of every conceivable motor trouble or possible failure in any part of the control circuits. Clear wiring diagrams are given for every circuit.

This book can save you expensive
and time-wasting breakdowns; can
help you get full benefit from today's
wonder-working direct current
equipment.

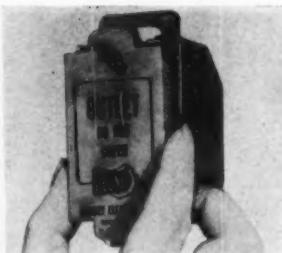
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The Macmillan Co., 60 Fifth Ave., New York 11

Please send me a copy of DIRECT CUR-
RENT MOTOR MANUAL @ \$3.50. I
will either remit in full or return the
book within 10 days without further
obligation.

Signed.....

Address.....



Outlet Cap

(26)

is equipped with 5-foot cable on remote unit, but can be extended to 25 feet with addition of an accessory 20-foot extension cable. Inputs, outputs, and power source all connect to amplifier chassis instead of to remote control unit. Power consumption is 150 watts normal at 117 volts 50-60 cycles.

Bell Sound Systems, Inc., Columbus,
Ohio.



Beam Clamp

(29)



Conduit Locknuts

(27)

New conduit locknuts for electrical wiring are now available for all 14 standard sizes of rigid electrical conduit from $\frac{1}{2}$ inch to 6 inch inclusive. These locknuts are of a rugged durable construction, sizes $\frac{1}{2}$ inch through 1 inch being fabricated of heavy gauge stamped steel, sizes $1\frac{1}{4}$ and larger of malleable iron. All sizes are cadmium plated to resist corrosion. Approved by Underwriters' Laboratories.

Buchanan Electrical Products Corp.,
1290 Central Ave., Hillside, N. J.

Amplifier

(28)

A new remote controlled high fidelity amplifier has been introduced. Remote control unit has a selector that not only permits switching to and from phono and radio (or television), but also choosing correct equalization for all types of domestic and foreign recordings. In addition, there is one volume control, compensated for low level listening, plus one bass and one treble control having flat center position, with boost and attenuation. Unit

Announcement has been made of the development of a new heavy-duty, adjustable beam clamp. It has been designed to suspend heaters, motor platforms, lighting fixtures, fans or blowers, conveyors, exhaust ducts, loud speakers and many other types of overhead-mounted equipment from structural members of buildings. Beam clamp can be attached to standard I, inverted T, or H beams as well as trusses and girders consisting of angles or channels back-to-back. Because of its adjustable feature, clamp will fit heavy structural members ranging from 4 to $8\frac{1}{2}$ inches in width. Clamp is tapped for a $1\frac{1}{4}$ inch pipe thread connection.

Thompson Electric Company, 1101-
57 Power Avenue, Cleveland 14, Ohio.

Glass-Fiber Material

(30)

Development of a new glass-fiber tube and pipe material, designed as a replacement for steel and other critical war metals in many commercial applications has been announced. Known as Glasweld, it has the strength of steel and is rust and corrosion proof. It is now available as piping in the oil and chemical processing industry and as tubing for the building, electrical and allied fields. Glasweld is a laminated tubing in which glass fibers, in the form of cloth, mat or tape, are bonded with resins to develop a rugged tube impervious to extreme heat, chemical action and sledge hammer blows.

United States Plywood Corp., 55
East 44th St., New York 18, N. Y.

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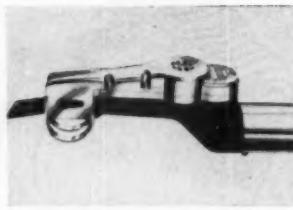


with a little GOLD SEAL TAPE

You can talk all you want to—Gold Seal is the best buy in tape. It sticks to the job. Laboratory control of production assures lasting "tack" in the friction compound. And it goes further. There's more tape value in every roll because there's no waste. In 10-roll cartons and single rolls—each roll cellophane-wrapped for factory-freshness. Jenkins Bros. (Rubber Div.), 80 White St., New York 13, N. Y.



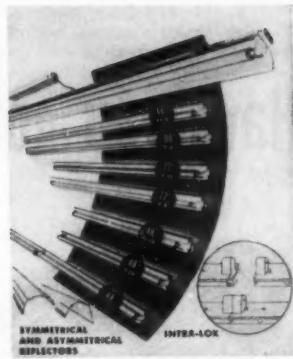
Gold Seal Tape
FRICTION AND RUBBER TAPES
MADE BY JENKINS BROS.
MAKERS OF FAMOUS JENKINS VALVES



Electric Saw (31)

Announcement has been made of a new all-purpose "roughing-in" reciprocating saw powered by a $\frac{1}{4}$ inch drill. It is for all types of "keyhole" or other "on-the-job" sawing. A built in blower keeps the Super-Saw cool and, by directing air flow towards the blade, keeps the cutting line from being obscured by chips or saw dust. An assortment of special blades permits cutting almost all types of materials and the $\frac{1}{2}$ inch stroke allows the tool to be used in places too cramped for a normal saw stroke. All friction surfaces are of "Oelite", phosphor bronze or high speed ball bearing, and all parts subject to wear are replaceable. It measures $10\frac{1}{2}$ inches overall, and weighs 3 lbs. 6 ozs.

RCS Tool Sales Corp., Joliet, Ill.



Fluorescent System (33)

A new extra-shallow fluorescent lighting system for slimline and 40-watt bipin lamps, called "Strip-Line" has been announced. Shallow channel-depth of less than one inch (15/16 inch) makes it possible to use this system in extremely limited space. Available in seven different types, which include sections for 96, 72 and 48 inch T-12 and 96 or 72 inch T-8 slimline lamps, as well as for one and two single 40-watt general service bipin lamps. Channels may be mounted in vertical or horizontal position, and are available with symmetrical or asymmetrical reflectors.

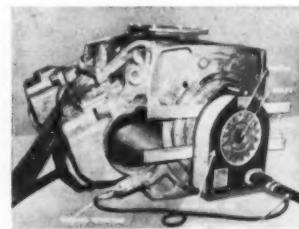
Benjamin Electric Mfg. Co., Des Plaines, Ill.



Ditcher (32)

A new "Runabout" ditcher equipped with "Hydracrowd" control has been announced. Except when in over-the-road travel speed, operator has full control of forward and reverse speed through a hydraulic valve. As valve is gradually opened, speed of machine increases up to a maximum of 16 ft. per minute. Reverse of machine, to clear obstructions, etc., is controlled by another hydraulic lever immediately adjacent to speed control valve. In addition to multiple selection of feeding speeds, there are three separate bucket line speeds which may be selected. To run machine operator can either stand on ground or remain seated in cab. All operations and controls are visible and accessible from either position.

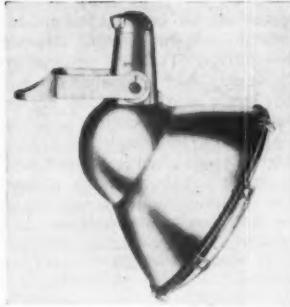
Barber-Greene Co., Aurora, Ill.



Induction Heater (34)

A new induction pinion heater for removing pinions easily without damage, has been announced. Heater generates heat within pinion; surface is not overheated and pinion can be removed with light pressure, applied by means of either wedges or a pinion puller. Heater is insulated with AIEE Class "H" materials. To induce heat in the pinion, it is essential to have a magnetic coupling between the coil and the pinion. The same plug and cable connection can be used with an assortment of different size coils.

National Electric Coil Company, Columbus 16, Ohio.



Floodlight

(35)

A new 18 1/2 inch reflector, aluminum floodlight, known as "Sportslite" has been announced. Series 4000 is available in open or enclosed type in narrow or medium beam. Narrow beam type has polished Alzak reflector, medium base, diffuse or Matte Alzak. Mounting fittings include crossarm, wall, clamp and pole types. Yoke type bracket to which mounting fittings are attached, permits unit to be swung over to crossarm or platform for cleaning or relamping. Open types may be converted to enclosed type, even after installations.

Steber Manufacturing Co., Broadview, Ill.

Gearshift Drive

(36)

Announcement has been made of the addition to this line of a new 5 hp 1200 rpm selective-speed gearshift drive. Designated as Type R3AC, it incorporates both primary and secondary gear reductions and is designed to individually motorize and drive machinery of various types that require a low range of selective operating speeds, combined with high radial load capacity. Drive is a combination of a 5 hp 1200 rpm integrally mounted electric motor and a four-speed sliding gear transmission, having selective primary gear ratios of 4.15, 3.15, 1.85 and 1.00 to 1, and a secondary gear train with optional ratios of 2.25, 2.06, 1.89, 1.74, 1.60, 1.48, 1.36, 1.26, 1.17, 1.08, or 1.00 to 1, providing a choice of output speed combinations from 123 rpm to 1140 rpm. Overall dimensions including standard 5 inch output shaft extension are 31-11/16 inch in length, 12 1/2 inch in height and 18 1/4 inch in width, including gearshift lever. They operate on polyphase, ac power supplies of 25, 50 and 60 cycles, and voltages below 600.

The Lima Electric Motor Company, Lima, Ohio.

**"Slickest tool
I ever used"**

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Ramset Dual-Action



TAP IT . . .



OR TURN IT . . .



That's what both owners and operators say about the exclusive, new, TAP-TURN combination on the improved RAMSET DUAL-ACTION TOOL, for instant fastening into steel or concrete. Overhead, in floors, roofs, walls, and in tight spots, RAMSET seats the fastener in split-second time, with hair-splitting accuracy. TAP IT . . . OR TURN IT . . . whichever suits the job best. You save time, money, trouble with RAMSET DUAL-ACTION FASTENING TOOL.

Besides DUAL-ACTION, RAMSET SYSTEM gives you the shortest, lightest, strongest powder-actuated tool. Easy to carry, easy to use. Selected powder charges control penetration . . . no extra small parts needed. And, the greatest variety of steel drive pins and studs gives RAMSET wide versatility for fastening or anchoring work in steel, concrete, other building materials.

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That's all your nearby RAMSET Specialist needs—15 minutes to demonstrate the outstanding features of RAMSET DUAL-ACTION and how they will slash fastening costs and get your work finished faster. Write or wire for details and demonstration.

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case and
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test leads.

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reads current without
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Look what you can do with this one pocket-size instrument: Determine load conditions without having to shut down equipment. Spot motor overloads and underloads. Diagnose trouble calls faster, under actual load. Measure voltage at motor terminals. Set overload relays. Load balancing, etc.

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MODEL A-6

Amps: 10/25/50/100/250 Volts: 150/600
(2 other popular models also available)

Send for 16-page manual, "How to Make Your Job Easier With An AMPROBE". Pyramid Instrument Corp., 49 Howard Street, N. Y. 13, N. Y. (Export Dept.: Marke Exporting Corp., 439 Broadway, N. Y. 13, Cable: Markebon).

AMPROBE

A PYRAMID INSTRUMENT

See it today at the better electrical distributor

Motor

The ACA motor (ac adjustable speed) is now available with a mechanical follow-up control for achieving a fixed preset speed without use of control equipment. This device enables a predetermined speed to be set manually by a knob either directly on ACA motor or at end of a flexible cable 10 or 15 feet away. Speed adjustment can be made while motor is at a standstill or while running. Speed control is obtained by rotating brushes around commutator. In operation, the new mechanism actuates a pilot motor which drives brushes to a position corresponding to setting of speed adjustment knob. A stop or automatic slow-down returns brushes to lowest speed position without disturbing original setting.

General Electric Company, Schenectady 5, N. Y.

(37)

row precision ball bearings and removable head axle-fitted with Alemite grease fittings. Trolley is powered by a crane-duty high-torque totally enclosed motor of 30 minute, 55 degree rating. Magnetic contact panel is equipped with transformer to reduce voltage in single speed pushbutton control circuit. A four button control station is provided to operate single speed trolley and hoist motions.

Industrial Equipment Co., 315 N. Ada St., Chicago 7, Ill.

Motor Generator Cleaning (40)

A new technique that cleans motor generators by simultaneously blowing and vacuuming within the air tight confines of the "Bio-Vac" cover has been introduced. Constructed of heavy cotton drill, coated inside and out with oil-resistant Neoprene, and fitted with 15 strategically located two-way zippers, the cover is patterned to fit all Otis type motor generators from No. 1's to No. 5's inclusive. With cover draped over motor generator, zippers are opened only where blower is inserted.

Lehara Sales Corp., 485 Fifth Ave., New York 17, N. Y.

(38)



ROUND COLUMN LIGHTS have been added to this line of square types. These include a six lamp (40 watt fluorescent) for mounting on existing 2 inch pipe, the same unit on an octagon standard and a four lamp wall mounted type. Curved, ribbed diffusing glass panels are set in frames of heavy extruded aluminum. New square types are also being added and include an eight lamp (40 watt fluorescent) type with steel standard and a similar unit with illuminated display case in lower section. Manufactured by Steber Manufacturing Co., Broadview, Ill.

Trolley

(39)

Announcement has been made of a new motor driven trolley, known as Moto-Trolley. It is designed for attachment to standard lug-mounted electric hoists and may be adjusted to accommodate a wide variety of beam sizes. It has crown-tread machine steel wheels with hardened drivers. Each wheel is equipped with double-

Thermostat Dial (41)

A new "warmer-cooler" temperature dial has been announced. This new guide on Magic Dial makes it possible for user to "tune in" heating comfort instead of selecting a certain number of degrees. By use of thermostat, roller-coaster temperature changes are eliminated and a heating system can be operated as though made for an individual home. Heat flow is automatically controlled to provide proper amount by permitting variance of length of time the burner operates.

Perfex Corporation, 500 West Oklahoma Ave., Milwaukee 7, Wis.

Product Briefs

(42) Announcement has been made by National Supply Co.'s Spang Chalfant Div., Pittsburgh, Pa. of a new electrical raceway, called "Central" electrical metallic tubing. . . . (43) Line Material Company, Milwaukee, Wis., has introduced a new inhibited transformer oil, known as Orto, that resists oxidation, acidification and sludging. . . . (44) Elastic Stop Nut Corp., Union, N. J. has announced a new Rollpin, an all-purpose pressed-fit pin. . . . (45) An improved self-contained Unitaire air conditioner is now available from Westinghouse Electric Corp., Sturtevant Div., Boston, Mass.

(46) Raytheon Mfg. Co., Waltham, Mass. has introduced a new line of bench welding equipment. . . . (47) Kepco Laboratories, Inc., Flushing, N. Y. has announced a new model 515 voltage regulated power supply. . . . (48) A new, improved, white steel measuring tape has been put on the market by Evans & Co., Newark, N. J.

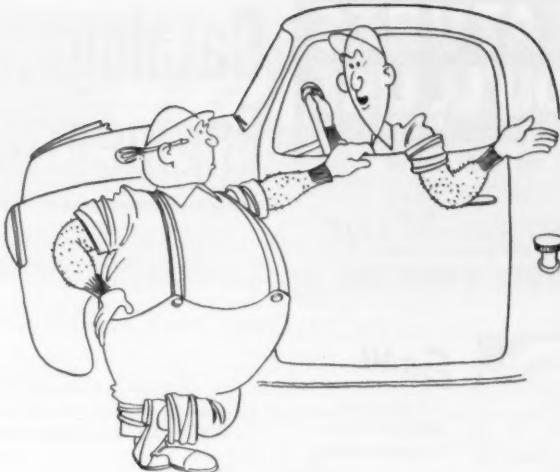
(49) Illuminated numbers to indicate the size of one's feet, for use in shoe stores, announced by General Electric Co., Cleveland, Ohio. . . . (50) A new Fan-Glo Heetaire with the built-in thermostat is being manufactured by Markel Electric Products, Inc., and LaSalle Products, Inc. of Buffalo, N. Y. . . . (51) Robbins & Myers, Inc., Springfield, Ohio, has announced the addition of two new vaneaxial type, medium pressure, propeller fans.

(52) Armstrong Products Company, Milwaukee, Wis. is now producing a new type centrifugal clutch adaptable for both electric motors and internal combustion engines of $\frac{1}{2}$ to 6 hp. . . . (53) Corning Glass Works, Corning, N. Y., has introduced a new black-light-blue, an ultraviolet transmitting tubing for use in the neon sign industry. . . . (54) A new, cartridge-type hydraulic pressure electric switch has been announced by Pantex Manufacturing Corp., Pawtucket, R. I.

(55) A new selenium rectifier has been developed by Vapor Heating Corp., in cooperation with Triple A Specialty Company, both of Chicago, to convert 110 and 220 volt dc to 74 volt dc to operate vapor hot water heaters. . . . (56) Three new soldering tips for the Cal "88" single pole soldering gun have been announced by Caliri Mfg. Co., Inc., West Orange, N. J. . . . (57) Janette Manufacturing Company, Chicago, has announced the addition of its "BO" type gear-motor to the speed reduction line.

(58) Westinghouse Lamp Division, Bloomfield, N. J., has developed a new light bulb for use in railway signal lamps. . . . (59) Executone, Inc., New York, N. Y. has announced that the new intercom features unit construction, saving considerable time when user wants to expand or service his system. . . . (60) A method for applying sheathing of aluminum to telephone and electric power cables has been developed by the Aluminum Company of America, Pittsburgh, Pa.

(61) Continental Electric Co., Hawthorne, Calif., has announced a new design of electric magnetic chuck for use on lathes. . . . (62) Special carbide-tipped blades for the "Quick-Saw" line of portable electric saws has been announced by Black & Decker Mfg. Co., Towson, Md. . . . (63) A new development in extension scaffolds, known as the "Over-Reach", has been announced by Atlas Industrial Corp., Brooklyn, N. Y.



"He wants 600 feet of temporary lighting strung in an hour!"

P.S. Even with sturdy, easy-to-wire P&S devices it'd be hard to string 600 feet in an hour. But wise electricians know that any P&S device is quick and easy to install, helps speed emergency jobs.



use this Pin Type Lampholder for temporary lighting

This husky bakelite P&S Pin Type Lampholder is approved for either indoor or outdoor lighting. It is applied directly to the wire — no need to strip, splice, solder or tape wires. Sharp pins pierce insulation, make positive contact, and wires are held in place by the lampholder cap. The P&S No. 5464 Pin Type Lampholder may be positioned or respaced at any time — the pin contacts do not injure insulation, so both wire and lampholders may be used over and over again. Detachable hook, as illustrated, is supplied with each lampholder for hanging from tree or messenger wire. Use the P&S 5464 Pin Type Lampholder wherever you need temporary inside or outside lighting. Rated 660 watts, 250 volts; for No. 12 or No. 14 stranded wire.



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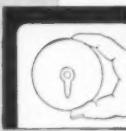
IN THE NEW
SERIES TS50

INTER-MATIC TIME SWITCH



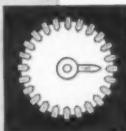
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TIME SWITCH

Catalogs, Bulletins and Engineering Data

(64) FLUORESCENT STRIP lights of five sizes are described with specifications, mounting information, dimensions and parts in data bulletin. Benjamin Electric Manufacturing Co.

(65) HEAVY DUTY CONNECTORS rated at 250-volts dc and 600-volts ac are discussed in 12-page 2-color bulletin M2-1950. Cannon Electric Development Co.

(66) RADIATION laboratory equipment is cataloged with condensed facts, prices and pictures of over 30 special items. General Electric Co.

(67) FLOODLIGHTS from 100- to 1500-watts, designed for homes, commercial, industrial and sports applications are presented in bulletin 128-50. Steber Manufacturing Co.

(68) HOME PLANNING is subject of 24-page booklet B4671 titled "Design Details for Electrical Living Homes". Westinghouse Electric Corp.

(69) DRY TRANSFORMERS, including open coil and completely enclosed types, unit substations and core and coil units, are subject of 12-page bulletin R. E. Uptegraff Mfg. Co.

(70) MINING CABLE manual is 72-page bulletin H433 giving complete data on all types of cable used in or about mines. Hazard Insulated Wire Works, Division of Okonite Co.

(71) SECTIONAL SCAFFOLD specification catalog includes data on load tests, safety rules, assembly parts and methods of assembly. Wilson-Albrecht Co., Inc.

(72) OBSTRUCTION LIGHTING for aeronautical applications, including sketches and photographs showing installations on all types of stacks, towers, tanks and similar structures are contained in catalog 50. Thompson Electric Co.

(73) OPERATORS for doors, gates, grilles, conveyors, skylights, awnings, folding partitions, windows and stage

curtains are discussed in file sheets SM, SL and SW. Robot Appliances.

(74) METAL BOOM with hydraulic operation and self-leveling working cage that reaches 40-foot height is discussed in 6-page 2-color folder. Capital Industries, Inc.

(75) OUTDOOR SWITCHGEAR, with ratings and dimensions, floor plans, circuit arrangements and diagrams of standard assemblies, is presented in bulletin 18B6142A. Allis-Chalmers Manufacturing Co.

(76) EMPLOYMENT of apprenticeship directors by union-management committees is discussed in terms of their function, how they are financed and the kind of programs needed in technical bulletin T125. United States Department of Labor.

(77) PRECIPITRON electronic air cleaner for the home is subject of 16-page booklet B5156 containing details of ductwork required, method of operation and details of construction. Westinghouse Electric Corp.

(78) ELECTRICAL TAPE to protect pipelines against corrosion by water, acids, oils and alkalies is described in 4-page brochure. Minnesota Mining and Manufacturing Co.

(79) AC POWER PLANTS for the farm, home, industry and institutions are discussed in 2-color 6-page folder including data on generating equipment from 500 to 15000-watts capacity. Kato Engineering Co.

(80) DISPLAY LIGHTING through the use of swivelite units combining flexible shafts, interchangeable sockets, canopies, housings, louvers and lenses is discussed in AIA file 31F23. Amplex Corp.

(81) VARIABLE TRANSFORMERS, oil-cooled and explosion-proof models, motor drives, line correctors, rating charts and volthbox ac power supplies are sketched, dimensioned and discussed in bulletin P550. The Superior Electric Co.

(82) THE LIGHT TOUCH is the title of an 8-page booklet showing how miniature lamp bulbs can be used in toys, specialties and premiums. 3-042. General Electric Co.

(83) POWER DRIVE pipe cutter is described in 4-page flier giving advantages, construction features and applications. Beaver Pipe Tools, Inc.

(84) SPORTSLITERS, series 4000, for illuminating variety of sports areas, railroad yards, construction projects and parking lots is subject of 6-page folder 127-50. Steber Mfg. Co.

(85) THERMAL SWITCH incorporating built-in bimetal elements in small snap-action unit is presented on Data Sheet 56. Micro-Switch.

(86) EXPORT DOCUMENTS, terms of payment, letters of credit and required correspondence for selling products in other countries are discussed in pocket-sized folder. D. W. Onan & Sons, Inc.

(87) VIBRATION isolators and shock mounts for industrial, marine and mobile equipment are described with charts, diagrams and text in 12-page catalog 504. The Barry Corp.

(88) BOX CONNECTORS, conduit fittings, entrance fittings, locknuts and bushings, couplings, tools, clamps and adapters are pictured, described and priced in schedules BC, CF, EF, LB, TW and CDC. Appleton Electric Co.

(89) FIBERGLAS-reinforced alkyl base polyester laminate for electrical insulation is described in 8-page manual. Laminated Plastics, Inc.

(90) FUSE LINKS are described with fusing charts, photographs, text and data in 16-page bulletin 104B. W. N. Matthews Corp.

(91) RESIDENTIAL electrical packages for added sales features to builders and contractors, showing floor plans and wiring details for modern kitchens, laundries, bathrooms, etc., are presented in 31-page booklet B4691. Westinghouse Electric Corp.

(92) AUTOMATIC auxiliary lighting that cuts in when main power sources fail is subject of 2-color 4-page folder. Electric Cord Co.

(93) ROLLING SCAFFOLDS of sectional aluminum are discussed in 4-page bulletin. The Patent Scaffolding Co., Inc.



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Reader's Quiz

Motor for Air Compressor

QUESTION—We have a 5 hp 3 phase Peerless motor on air compressor duty that will blow fuses occasionally. It has no type number, 220-440 volts operating on 220. At times, it will go for several weeks without blowing fuses and sometimes it will blow several in a week, not always the same fuse blows. The overload heaters are the ones sent with this motor and switch and never kick out until one fuse blows. The motor circuit is fused with 30 amp. Fusetats. Could it be possible the voltage is sometimes too high and causes too much starting current? It has never gone over 223 volts while I had a volt meter on it.—A.E.

ANSWER to A. E.—A five horsepower three phase squirrel cage motor operating on 220 volts will draw approximately 15 amperes running current.

According to the code, motor running amperes of 15 requires a supply line of number 12 wire.

The line fuse for number 12 wire should be a 40 ampere fuse. If a 40 ampere fuse is installed, I think your troubles will be over and you will at the same time coincide with the code.

The starting current for a five hp. motor is between 60 and 75 amperes and no doubt this is too much for the 30 ampere Fusetat.—B.A.S.

ANSWER to A. E.—In your particular case involving erratic operation of a motor used to drive an air compressor, I would conclude that the overload coils were too large. Motor manufacturers usually allow plenty of margin when they supply motors for air compressor service. The reason for this is that the torque requirements of an air compressor may be very large due to varying conditions of load and capacity. In your case, a careful check of motor currents both starting and running will be helpful in analyzing the trouble. The overload coils should be reduced to a value that will protect the motor.

It is also well to bear in mind that any electric motor driving a mechanical device is subject to reflected troubles. In the case of an air compressor, this is a common occurrence. Any in-

termittent or deteriorating troubles occurring in the compressor itself are reflected back to the electric motor driving the compressor in the form of a demand for more torque and the motor tries to develop more torque by drawing an increased amount of current. This would appear to be a correct interpretation of the cause of your trouble provided that the overload coils are actually too large. A check of the manufacturers data should indicate the correct values.

In any event, I would check the air compressor thoroughly. The following points should be given consideration: check piston for broken or tight rings; check cylinder walls for scoring; check the air discharge check valve (this valve is located usually in the head of modern compressors—if you have an old compressor, this check valve may be either in the air discharge line itself, or at the inlet of the discharge line to the pressure tank—these valves must be in good condition (they are responsible for most air compressor failures); check the water accumulation in the pressure tank; check the oil level in the crankcase (it is a good policy to drain out dirty oil and replace with fresh every 30 days)—if the compressor is of a giant type, it may have a separate oil pump driven by an independent motor—if this is the case, be sure to check the operation of this pump and to remove and clean sludge from sump and piping regularly; check the automatic pressure unloading device (this is the equipment that releases the air imprisoned in the cylinders when the air compressor is stopped by the automatic pressure switch; check the automatic pressure switch to make sure that the compressor is cutting in and out at the correct pressures (pressures will differ with different use requirement); check entire air system and all piping for leaks (be sure to check also all pneumatic tools)—leaks will cause long operating cycles and short off periods for any automatically operated compressor; check the crank-shaft bearings for excessive wear (this is usually noticeable due to a tendency for the compressor to leak oil and air around the shaft just behind the flywheel and it may, of course, be audible); finally check for correct compressor rotation (flywheels on compressors usually have a rota-

tional arrow cast right in the metal—if no mark can be found, use this rule of thumb-facing the flywheel side of the compressor, if the electric motor is on your left, the rotation is clockwise; if the motor is on your right, the rotation is counter-clockwise—I might mention here that this problem of correct rotation is very important to the life and efficiency of the air compressor and also that this is the most frequent fault found to exist where three phase motors are used to drive the compressor due, no doubt, to the fact that the average electrician merely wires up the motor and leaves the job without ever thinking to check motor rotation requirements and interchange phase wiring to secure correct condition). A careful and systematic check performed at regular intervals will be very helpful in securing long and satisfactory operation from any make of air compressor.—H.T.O.

Transformers

QUESTION—We have been installing solenoids and control circuits at 110 volts, 60 cycle, from our 440 volt power circuits. This requires a transformer 440 volt to 110 volt. What size transformer should be used? For example, a solenoid with an inrush current of 10 amperes and a holding current of 1 ampere, I have been advised to use a transformer of 100% inrush to 25% inrush current. The difference in size makes quite a difference in cost, in which I am very interested, and would like to know what size transformer to use.—W.L.C.

ANSWER TO W. L. C.—Not knowing the operating conditions under which these motors are to be started, it is almost impossible to give a definite formula that will exactly fit your conditions. A basic formula is to install a transformer of sufficient capacity to carry the load of all the coils that are holding in and with sufficient additional capacity to carry the maximum number of coils that are liable to be closed at the same instant, without exceeding 150 percent of the capacity of the transformer. In closing, the coils are on for such a short time that their heating effect is negligible and the



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drop in voltage in the transformer, with 150 percent load, will not be sufficient to cause the coils, that are holding, to fall out.

As the coils take less than $\frac{1}{2}$ second to close, and during that time the current drops from the inrush value to the holding, it is seldom that more than one solenoid is energized at the same instant even in a large system. There are exceptions to this, such as a factory where a large number of motors are started when the whistle blows or in the case of a number of motors which operate a single machine and are all started from the same control switch.

Unless your motors are grouped closely together, and the leads from one large control transformer are short and the wiring is not excessive, I would recommend grouping the controls on several smaller transformers or using individual control transformers in each motor starter. These can be bought installed in the starter and save a lot of external wiring. This also has the advantage of not causing a general shutdown if the control transformer fails as in this case only one motor is affected.—A.E.T.

ANSWER TO W. L. C.—You can undoubtedly use a much smaller transformer than that required for 100% inrush current.

I believe that from a power standpoint, a transformer for 25% of the inrush current is applicable. However, I suggest that the voltage regulation or drop will determine how small a transformer can be used. This should be checked with the actual equipment since the voltage drop will depend upon power factor as well as load.

Another idea to keep in mind is the possibility of connecting several loads to one transformer. If this is possible, it will probably be found that a saving can be made in total transformer capacity or at least in cost. The saving in capacity or size could be made if it is impossible or unlikely for two or more of the loads to be drawing current at the same time.—P.S.

ANSWER to W. L. C.—This problem is similar to one that occurred frequently in Canada, where the standard voltage for power is 550 rather than 440. U. S. equipment would come in at 440 and the question would be as to the proper type of transformer to use to change from 550 to 440. The answer is the autotransformer. Especially when voltage changes from input to output are in the order of 4:5 (as above), the autotransformer effects a considerable saving over the cost of a standard transformer. And the regulation of the transformer is much better. In the particular case in question, the solenoid has an inrush cur-

rent of 10 amperes and a holding current of 1 ampere, at 110 volts ac. This means that theoretically if there was no regulation in the secondary, a 110 watt transformer could be used. If the regulation at full load is in the order of 7% then 10 amperes which is 10 times full load current, would cause a regulation of 70%. If we assume that the solenoid will operate satisfactorily with 90 volts ac, then the maximum regulation permissible would be in the order of 20%, which would mean that roughly a 300 watt transformer would be required. (3 amps at full load = 7%; therefore, 10 amps = 21% approx.). If, however, an autotransformer were used, the regulation would be at least half, and a unit of 150 watts capacity would do the job fine. Not only would the autotransformer be cheaper than the equivalent straight transformer, but it would be smaller and better. Use, therefore, an autotransformer of 150 watts capacity, 440 volts to 110 volts ac. If you can get the secondary voltage as 120 or 125 volts, all the better, as the higher secondary voltage will help the inrush voltage remain up.—H.H.S.

Resistance

QUESTION—Is there any practical method in use to determine the correct size of secondary resistance and wattage of the same to be applied with a drum switch to the secondary of a wound rotor three phase motor?

For example, assume that you had a 100 hp, 220 volt, 3 phase 60 cycle motor, that the original nameplate had been replaced by some motor repair company with their own, and the only information they supplied was that mentioned above. There is no marking on the shaft ends, keyway, etc. The only thing the manufacturer could assure you of is that this motor has a 100 hp, 220 volt, 3 phase, 60 cycle frame.

There is some method whereby you excite the stator with 220 volt, 3 phase and check the open circuit voltage on any two of the rotor rings.

Do any of your readers know this or other methods?—W.H.C.

ANSWER to W. H. C.—The power rating of the secondary resistors required by a wound rotor motor is dependent on the slip of the rotor, and the shaft power output. The slip, S , at a rotor speed, N , is given by the equation:

$$S = \frac{N_s - N}{N_s}, \text{ where } N_s \text{ is the synchronous rotor speed.}$$

The power dissipated in the external resistor, P_n , is given by the equation:

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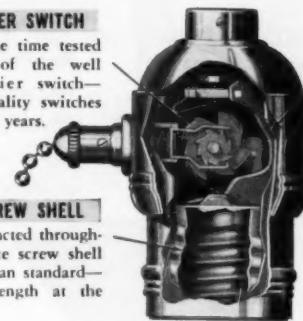
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$$P_r = \frac{P_s(S)}{1-S}, \text{ where } P_s \text{ is the shaft power output in watts.}$$

The allowable shaft power output varies directly with the speed and for a 100 hp. motor the power lost in the resistors at rated load is:

$$P_r = 74,600 \frac{N}{N_s} \frac{S}{1-S}$$

This is the total power lost and the power rating of each resistor is, of course, one third of this. As an example, the lowest continuous speed desired is $\frac{1}{2}$ of synchronous speed, the power output of the shaft would be 50 hp. or 37,300 watts. The power dissipated in the resistors would be:

$$74,600(\frac{1}{2}) \frac{(0.5)}{(1-0.5)}, \text{ or } 37,300 \text{ watts.}$$

Thus, each resistor must have a power rating of about 12.5 kw.

The resistance in ohms of the resistor is dependent on the rotor speed and also the rotor power output. The speed regulation of a wound rotor motor is very poor at reduced speeds, and a much higher value of resistance is required at low loads than heavier loads for a given speed.

The highest value of resistance required will be when the shaft is at its lowest controlled speed and with a very light load. This can be calculated approximately from the formula:

$$R = \frac{(SE)^2(1-S)}{3P_s(S)}$$

where R is the ohmic resistance of one leg of a Y resistor bank, P_s is the lowest shaft power in watts to be taken from the motor at the maximum value of slip, S, and E is the generated voltage, line to line, in the rotor at standstill.

E may be measured by applying one half voltage to the stator with the rotor blocked and multiplying the measured voltage by two. This reading should be taken as rapidly as possible and the rotor blocked securely as a considerable torque will be developed. This voltage may be measured at the slip rings with the brushes lifted.—J.J.L.

ANSWER to W. H. C.—There is no completely satisfactory way to determine the proper resistance for use with a slip-ring motor and drum controller without knowing both motor and load characteristics. Between different motors of the same horsepower and speed ratings, there may be considerable difference between best resistance values.

However, where there is no alternative, here is a method which will give results satisfactory in most cases.

With the rotor locked to prevent turning and the slip rings open cir-

cuated, put full voltage on the stator and measure the voltage between rings. It should be nearly the same for all phases. Now multiply stator volts by stator amperes and divide by the measured slip ring voltage. This gives approximate rotor amperes. (Stator values used should be for full load.) Since we don't know much about the motor or load, we can't figure on the basis of torque but, instead, we shall have to guess a suitable value of starting current, say 150%. Now take this percentage of the rotor amperes figured above and divide it into the measured slip ring volts, and you get a value of ohms for a delta connected resistor. Wye connected resistors are usually used, so divide by 1.73 and you get ohms per leg which will limit starting current to the chosen value. Actually, the value you have figured is slightly larger than required, but we can't say how much larger. It is safest to use the whole thing. Taps will have to be adjusted on the job. For the usual four-section resistor, a reasonable initial tap setting puts twice as much resistance in the last two sections to be shorted out as in the first two. Grids should be chosen on the basis of ohms, amperes, and whether they are for starting or speed-reducing duty.

The above method is not very suitable for figuring resistances for speed-reducing duty. Again, if there is no alternative, it will be necessary to know the horsepower required by the load at desired speeds. From this can be figured watts required, which must be divided by efficiency and power factor to give volt-amperes input. At low speeds, efficiency times power factor can be as low as 0.5. Divide volt-amperes by 1.73 times stator volts to get the current to be used in figuring a resistance.—J.W.T.

Ground Current

QUESTION—On our 110/220 volt secondary system, the neutral is grounded at the transformer and also in the residences to the water pipe.

We find, with a Weston clamp-on ammeter, current flowing (from 2 to 20 amp.) in the ground wire in the residences but not in the ground wire at the transformer.

By disconnecting the wire from a water pipe, we get a spark but a neon tester will not light when placed in series with ground wire and water pipe.

What causes this current to flow and what effect does it have on the circuit?
—A.C.J.

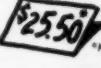
ANSWER TO A. C. J.—Under normal conditions, there is bound to be a

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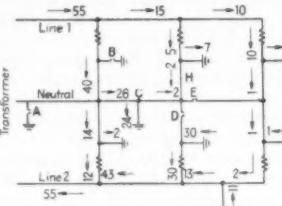
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certain amount of current flowing between neutral and ground. After all, ground is merely another conductor in parallel with neutral. With conductors of ample size and no faults in the circuit, ground current should be small.

An illustration of a number of possibilities appears in the diagram. The transformer ground at A is either broken or has such a high resistance that it is useless. The same condition shows in the ground at residence B. A neutral-to-ground fault appears at C. The grounded service drop is broken at D and the secondary neutral is open at E. F is a line-to-ground fault. Of course in practice, such a combination of conditions usually would be manifested by lights burning dimly—or even over-brightly.



Current values were chosen to give a balanced load at the transformer. It will be noticed that the current entering any junction point exactly equals the current flowing away. **THIS IS A CARDINAL RULE IN ELECTRICAL CIRCUITS.** Since ground can be regarded as a junction point, the sum of the four arrows pointing toward ground equals the sum of the three arrows pointing from ground.

In general, the current values in an alternating current circuit cannot be added arithmetically as was done in the diagram. Phase differences in the individual loads must be considered. Also, at every half-cycle, the arrows will reverse. Alternating current ammeters do not indicate direction of current flow. Any change in any of the loads will cause a complete redistribution of all current values. Consequently, a detailed survey and current mapping may be liable to considerable error. However, if only a few conductors are involved, readings on each branch from a junction point will give a basis for shrewd speculation.

It would appear from the actual system described by the questioner that ground is more conductive than the wires themselves. Copper size and continuity should be checked. Steps should be taken to reduce resistance of the transformer ground connection. Faults should be cleared in the entire network served by the transformer.

Under certain conditions, appreciable ground current can introduce

noise in communication circuits. In a case familiar to the writer, revenue was lost. The meter had its current coil connected in the grounded conductor similar to H in the diagram. Normally the meter ran forward, but certain load changes elsewhere on the system gave it spells of running backward—all due to service being taken through ground.—L.E.B.

Can you ANSWER these QUESTIONS

QUESTION J17—What is the best way to preserve buried conduit? In present shops, I find underground conduit that has been deteriorated completely in places, causing burned out feeders due to short circuit. This conduit was below the concrete imbedded in clay soil. In conduit work running from outlet to outlet, or switch to outlet underground, how can you eliminate moisture within the conduit? From my experience, moisture is created when a conduit is run underground to any service above the floor level. On some of the jobs, a drain hole can be used to rid the conduit of moisture, but in shops with no basement, this is not practical.—E. S. H.

QUESTION K17—One of our customers has a 104 hp. 1170 rpm., 2200 volt slip ring, wound rotor induction motor that has a very high speed vibration in it. The vibration is so fast that it would seem as if it were a frequency vibration though it persists for some time after the switch is cut. Please suggest what to look for?—D. M.

QUESTION L17—We have a 25 hp., 250 volt direct current compound wound motor operating a screw conveyor. For no apparent reason this motor will suddenly run away and begin sparking at the brushes. We have found that the way to prevent this condition is to keep the commutator covered with a heavy wax film or even to throw dust on it. What could cause this motor to act in this manner?—W. P. R.

QUESTION M17—Why do some magnetic parts such as ignition coils have no iron return path when nearly all power equipment such as motors or transformers always have a closed (or nearly so) iron magnetic circuit?—P. S.

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Fig. 700-701



Fig. 400

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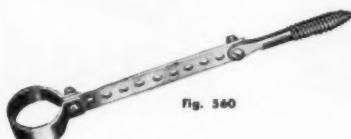


Fig. 360



Fig. 650

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Questions on the Code

Underground Wiring

Q. We have taken over the re-wiring for a number of gasoline bulk plants for one of the large oil companies in this area and wish to make use of underground wiring in preference to overhead between the various buildings on each property. Some time ago I understood the Code would accept the use of an underground cable for the wiring of a gasoline bulk plant providing this cable was kept a certain distance below the surface of the ground. In discussing this with one of our local inspectors, I have been informed that this cable must be of the lead jacketed type. As I would prefer to use one of the new neoprene types of underground cable, I would like to know whether or not you would accept such cable provided it was properly installed at a gasoline bulk station.—M.M.H.

A. I would not question the installation of an approved type USE cable having a neoprene outer jacket provided it was buried 2 feet or more below the surface of the ground at a gasoline bulk station. I admit that Section 5153 of the National Electrical Code contains the following ruling "Wiring located in not less than 2 feet of earth may be in rigid conduit or an approved lead covered cable assembly provided that rigid conduit is used where these cables leave the earth extending from a point of the lowest buried cable level to the equipment so served." I am unable to explain the wording "lead covered cable assembly" as used in this section of the Code but inasmuch as this type of cable does not provide a satisfactory life in climates where freezing temperatures are encountered, we have arbitrarily, in this area at least, accepted any type of USE cable having a neoprene outer jacket as being preferable to one with a lead jacket. Experience here has proven in many instances that a lead covered jacket will fail during the first or second winter following its installation. These failures are caused by minute quantities of moisture entering the pores of the lead jacket when temperatures are above freezing. Then upon freezing they expand these pores so that more moisture can enter and

freeze at a later time. This process continues until the jacket has actually opened giving moisture access to the center of the cable. Because of this condition, we have recommended the use of the neoprene jacketed cables in preference to the lead jacketed wiring. Possibly the best procedure in your instance would be to address a request to the Interpretations Committee as directed on Page 7 of the National Electrical Code to determine if it is not their intent that this wording should actually be "approved for the purpose" instead of "lead covered cable assembly" as it is now contained in the Code. In lieu of this, it would seem advisable for you to contact each inspector having jurisdiction over the plants you propose to wire and request from him consideration of the neoprene jacketed wire in preference to the lead covered cable as I believe you will encounter freezing temperatures below a 2-foot level in all the areas you propose to work in.—G.R.

Three-Way Switching

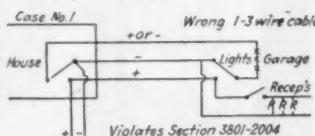
Q. In running a circuit underground from a house to a garage I plan to use armored cable lead. I wish to control the lights in the garage through a set of three-way switches. I am also installing some receptacles in the garage independent of the three-way switch control. What is required for the underground conductors? May I use one-three wire cable? Will two-2 wire cables be O.K.? Your advice will be appreciated.—A.M.P.

A. In order to properly wire the circuit you describe two Code rules must be satisfied. Section 3801 of the Code does not permit, in general, the placing of a switch in the grounded conductor. Section 3802 requires conductors in metal enclosures to have both polarities in the same metal enclosure. In order to comply with both of these rules, when armored cable lead is used you would need a two-wire cable and a three-wire cable for the following reasons.

1.—One three-wire cable could attain the results you desire if the three-

Three-way switching

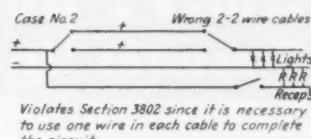
Case No. 1



way switches were connected with both polarities of the circuit connected to the switches. This connection would violate Section 3801 since the switches might disconnect either the live wire or the ground wire and the polarity at the lampholder, covered by Section 2004, would also be in violation of this rule.

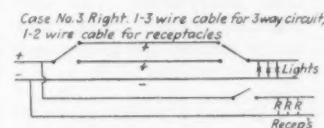
2.—The use of 2 two-wire cables would violate Section 3802 of the Code which requires both polarities of the

Case No. 2



circuit to be in the same metal enclosure. If the wiring method consisted of non-metallic underground cable two 2-wire cables could be used.

3.—The use of one two-wire and one three-wire cable would satisfy



both of these Code requirements.—B.A.McD.

Main Service Disconnect

Q. In a double house must there be a switch to disconnect the wires from both meters?—H.D.

A. No. Section 2301b of the N. E. Code permits buildings of multiple occupancy to have two or more separate sets of service entrance conductors to be tapped to one service



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drop. In other words the Code permits separate sets of service entrance conductors to be tapped to the same service drop and run separately to the service equipment of each of the occupants. Local requirements, however, might not recognize such procedure. Section 2351b also requires each occupant to have access to his service disconnecting means. This requirement is readily attained when separate sets of service entrance conductors are run to each occupant.—B.A.McDonald.

Grounding

Q. In a pump house where considerable moisture is present I have used a neoprene jacketed waterproof wire supported on glass insulators in preference to using conventional RW wiring in conduit due to previous experience in a building of similar use. The service equipment is located outdoors, is of the weatherproof type and is grounded as required by the Code. Now my question concerns the cast-iron motor control equipment located inside this pump house. Will the Code require that I carry a special grounding wire to ground this equipment?

—J.D.

A. Yes, the Code will require that this equipment be grounded. If you will refer to Section 4438 of the Code, you will note that controller cases except those attached to ungrounded portable equipment and except the line covers of snap switches shall be grounded regardless of the voltage involved. Therefore, inasmuch as you do not have a raceway system to which this controller can be grounded, it will be necessary that a special grounding conductor be used to make the installation conform to Code requirements.—G.R.

High Voltage Cable Splicing

Q. Is there a Code ruling that an approved compound shall be properly poured in a wiped lead sleeve joint, when lead covered underground primary cables 2300 volts and above are spliced in manholes below ground level?

If so is there a similar Code ruling covering telephone lead sleeve joints underground and overhead?—G.F.

A. Reference to the second paragraph of the Introduction of the N. E. Code will show that the provisions of the Code do not apply to an electric or communication utility

in the exercise of its function as a Utility, and located outdoors or in buildings used exclusively for that purpose. If the application you have in mind comes under this exception there are no applicable Code rules.

Article 710 of the Code covers circuits and equipment operating at more than 600 volts between conductors. Reference to these rules shows that Section 7115 briefly touches on your question. The last sentence says "The lead sheath should be continued over the splices." The use of the word "should" does not make the requirement mandatory but only advisory. As a result there are no fixed Code rules that cover the wiped joint and the proper compound to be used. Article 800 of the Code covers communication circuits which includes telephones. Reference to this Article shows that no reference is made to the correct procedure to be followed in making lead sleeve joints either underground or overhead on telephone circuits.

—B.A.McD.

Panelboard Overcurrent Protection

Q. A factory has a square duct running length of building. If you want to connect an eight circuit lighting cabinet to the duct, must the mains be fused?—H.D.

A. Section 3882 of the N. E. Code requires a panelboard supplied by conductors having overcurrent protection greater than 200 amperes to be protected on the supply side by overcurrent devices having a rating not greater than that of the panelboard. If snap switches rated 30 amperes or less are employed in the panelboard, the panelboard protection may not exceed 200 amperes. The above rule would permit the connection of an eight circuit lighting cabinet without overcurrent protection in the cabinet provided the feeder overcurrent protection did not exceed 200 amperes.

—B.A.McD.

Q. Can I run a circuit to feed 3 motors; end in a box, then feed each motor with right size of wire? The circuit would be properly fused.—H.D.

A. This may be done in some cases where all of the requirements of Section 4343 of the Code are satisfied. Section 4343a would permit two or more motors not exceeding 1 horsepower or a full load current rating of 6 amperes to be placed on a 20 ampere, 125 volt circuit or a 15 ampere circuit operating at 600 volts or less, provided there was no conflict with Section 4322.

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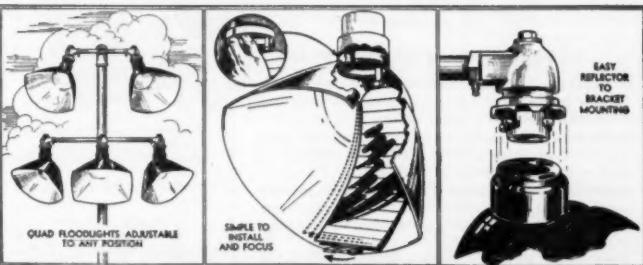
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For example: If the motors were automatically started each motor must be separately protected as required in Section 432c.

In addition to the above two or more motors of any rating may be connected to one branch circuit provided the following requirements of Section 434b are satisfied.

1.—Each motor must have individual running protection.

2.—Each motor running overcurrent device or each motor controller must be approved for group installation.

3.—The branch circuit fuses are calculated as covered in Section 4342.

4.—The branch circuit fuses must not be larger than allowed by Section 4330 for the thermal cutout protecting the smallest motor of the group.

5.—Taps, without individual protection to each motor may be made if the provisions of 4343b-5 are satisfied.

—B.A.McD.

Wiring a Grain Terminal

Q. We are now in the process of designing the wiring installation for a good sized grain terminal and we propose to use a dust-tight room for the location of all motor control equipment. Now our question pertains to the auxiliary gutter which we would like to use in connection with this control equipment. As there will be between 25 and 30 motors in this plant, we would like to mount all this control equipment along one wall of this dust free room and then drop from each piece of equipment into a fabricated auxiliary gutter located just above the floor level. As all motors are three-phase this will mean between 75 and 90 conductors in addition to the control and signal conductors all of which we would like to place within this one auxiliary gutter. Now the local inspector questions whether or not such an installation would be in conformance with the Code but we have pointed out to him that inasmuch as this is not a wireway or a busway but is simply an auxiliary gutter connecting up a number of motor controllers, it is actually a junction box from which conduit emanate to various portions of the plant. We, therefore, would appreciate your thoughts concerning Code regulations governing such an installation.

—F.W.

A. Without a doubt the inspector is correct in questioning this installation as the Code would limit the number of current carrying conductors within such an auxiliary gutter to 30. In the first place, this actually is not a junction box but instead is an auxiliary gutter as defined under Section 3741 as it is used to supplement

the wiring space at a control center. Then under Section 3745 of the Code you will note that auxiliary gutters shall not contain more than 30 conductors at any cross-section unless the conductors are for signaling circuits or are control conductors between a motor and its starter and are used only for starting duty. The sum of the cross-sectional area of all contained conductors at any cross-section of an auxiliary gutter shall not exceed 20% of the interior cross-sectional area of the gutter. Therefore, it will be necessary in this case to provide either three gutters or to sub-divide one gutter into three separate wiring raceways of ample cross-sectional area to conform to Section 3745.—G.R.

Service Equipment and Panel Locations

Q. I have had trouble with the local electrical inspector for quite some time on the question of location of breaker panels, in residential as well as commercial buildings. As far as I can determine, the question is not covered in the code.

The code says that a breaker or group of breakers used as a service disconnect means shall be at a point nearest entrance of conductors, either inside or outside the building.

The question is, how far inside the building is it permissible to put the service disconnect means? There should be a ruling in feet or a definite statement.

Also what is the minimum height a panel can be mounted? The inspector says six feet and we have one 46 inches (for the reason of construction.)

Can the panel be mounted near plumbing equipment or water lines or faucets and is there any prohibited location such as a boiler room or bathroom?—R.W.O.

A. Section 2351a of the N.E. Code covers this question and requires the service disconnecting means to be located at a readily accessible point nearest to the entrance of the conductors, either inside or outside the building wall. Reference to the Code definitions "readily accessible" further clarifies the above requirement.

As you say, however, the fact remains that there is no definite Code requirement with respect to the distance in feet within which the disconnecting means must be located. The intent of the rule is to safeguard the hazard presented by unprotected service conductors inside a building and it is the concern of both the contractor

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and the inspector to see that this end is achieved under the circumstances presented on the job. To all of us concerned with the electrical wiring industry it is desirable that the Code rules be definite. At times, however, it is difficult to do so without severe complications. I believe this Code requirement comes under this classification and in order to clarify the point I cite the following example or an appropriate illustration:—

Lets assume that the Code definitely limits the distance to not more than 10 feet. If we do so we cannot fully avail ourselves of the provisions of Section 2351a which permits six means of disconnect for the service. Assume that you wish to install six 400 ampere service switches as the service disconnect and you will find that when you reach the last switch you will be about 25 feet or more inside the building. If each switch is separately metered the distance will be increased. If we had a definite 10 foot requirement such an installation could not be made.

In general, my experience shows that this rule as now worded is satisfactory and is the source of little complaint and maybe fully satisfied if both the contractor and inspector, irrespective of the Code phraseology, sees that this disconnect is located as near as possible to where the service wires enter the building. If the service wires do not enter at a point to promote compliances with this rule, they should be changed.

In reply to your second question concerning panelboards, the Code does not state any minimum distance above the floor that must be satisfied. Since panelboards contain overcurrent protective devices, Section 2435 of the Code would influence the setting of the panelboard. This rule requires such devices to be readily accessible. Reference to the definition of "Readily Accessible" shows that the need for the use of chairs or ladders to reach an overcurrent device does not satisfy the requirement. This limits the height at which the panel may be placed. Outside of the Code requirements, local provisions or utility requirements may have a definite bearing on your question.

There is no Code provision which prohibits a panel to be located near plumbing equipment, water lines, faucets or in bath rooms. They may also be installed in boiler rooms provided proper designs are used to satisfy the dusts or corrosive influences that may be present in such a location. The advisability of installing panels in bath rooms is questioned, however, by many authorities and should be discouraged. for that reason.—B.A.McD.



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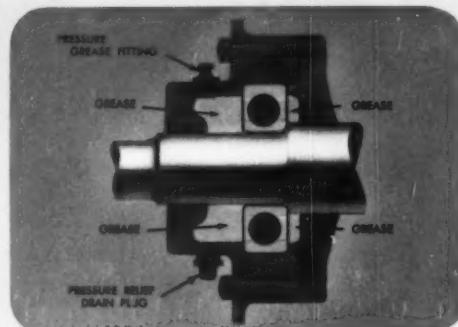
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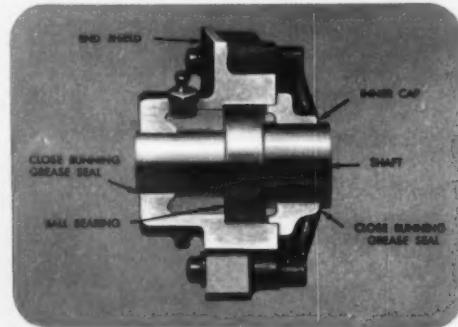
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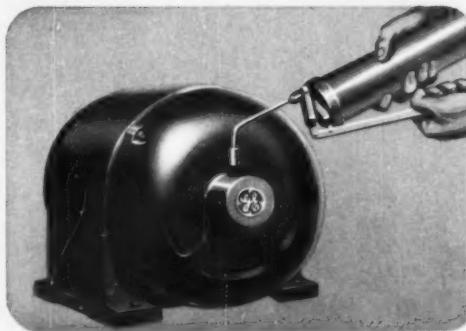
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Wound Rotor Motor Controller

Q. I recently installed a large air conditioning unit consisting of a wound-rotor induction motor, a drum type controller and separately mounted resistors. The inspector insisted that the conductors between the resistance elements and the controller be of the AVB type. I planned to use type RH conductors. I can't find anything in the Code under motors and controllers that justifies the inspectors order. Kindly explain.—C.K.

A. The N. E. Code requirement covering this question does not appear under the Article on Motors. It is definitely covered, however, under Section 4705, Resistors and Reactors, and requires conductors between resistance elements and controllers to be suitable for an operating temperature of not less than 90° C (194° F). This requirement does not apply when the controller is used for motor-starting service. It is evident in this case that the controller will be used to regulate the speed of the motor and the rule therefore applies. Since type RH conductors have a maximum operating temperature of 75° C, they do not satisfy this Code requirement. Type AVB insulation has a maximum operating temperature of 90° C and satisfies the requirement of the inspector. Reference to the Conductor Table under Section 3102 also shows, other insulations might be used if limitations shown are not exceeded. Since this specific requirement which concerns wound-rotor motors might easily be missed under its present location in the Code it appears that a cross reference or direct statement under Section 4313 would eliminate this possibility.—B.A.McD.

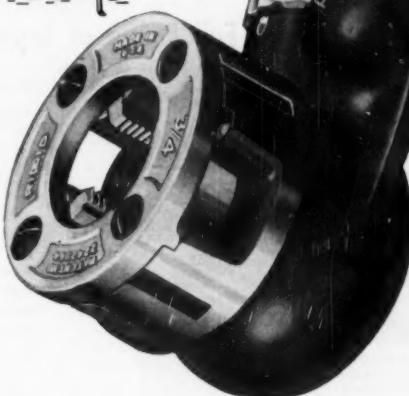


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1. FS AND FD PYLETS AND COVERS—1, 2, 3 and 4 gang, square corner types, take all standard switch and receptacle plates.

2. ROUND BASE PYLETS AND COVERS—Ideal for Vapor-tight junction boxes—Flush and surface mounting. Take standard 4-inch outlet box cover; also vapor-tight fixtures, plug receptacles and flexible fixture hangers.

3. VAPORTIGHT LIGHTING FIXTURES—With heavy cast metal bases, weathertight sealing and sturdy guards. Complete line, for 10 to 200 watt lamps, for conduit or wall mounting, universal 4 and 5 hub types, two and three gang, handrail and outlet box types, also midget fixtures.

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5. CAST METAL SAFETY SWITCHES AND CIRCUIT BREAKER PYLETS—Heavy duty safety switches and fuse boxes with or without plug receptacles and circuit breaker Pylets with all features for reliable service under severe conditions. Safety switches have quick make and break, interlocked cover and weathertight gaskets on both cover and hub plates. Available with interlocking plug receptacles.

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Refer to your Pyle Catalog 1100 for complete listings including plugs and receptacles—explosion-proof pylets, cord and cable grips—flexible conduit couplings—unions—reducers—elbows and grip handles—portable hand lamps.

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Industrial Electrification

Electrical Recording Instruments—Part II

How to extend the range of an electrical recording instrument. Some instrument applications in the field of electrical power measurement and analysis.

FREQUENTLY it becomes necessary to increase the range of a recording instrument over and above its basic, self-contained range. For example, a voltmeter may have a scale reading of 0 to 150 and it may become necessary to check a circuit of 500 or 750 volts. Rather than have a voltmeter for every voltage range, an instrument transformer is employed in the case of ac measurement and a fixed resistance in the case of dc measurement.

Instrument transformers reduce the voltage or current of the main circuit to values suitable for the instrument circuits; also provide proper insulation between the main and instrument circuits. There are two distinct types: current transformers, for reducing by a known ratio the current in the circuit to be measured, to the current value of the recorder (usually 5 amperes); and potential transformers, for reducing high voltage with a fixed ratio of transformation to a low value (usually 120 volts) which can be safely applied to the instrument potential coils.

Formerly it was necessary to carry a number of portable transformers of different sizes in order to adapt instrument ranges to different circuit capacities. Portable current transformers are now available having several primary ranges to measure circuits from 10 to 1,000 amperes. The multi-range transformer shown in Fig. 5 is a closed core or universal type current transformer having nine primary ranges (10, 12.5, 25, 50, 100, 160, 200, 400, and 800 amperes) to 5 amperes secondary. Five of these ranges are obtained by means of a wound primary; four by looping the primary conductor through an opening in the core and case.

Where it is difficult or impractical to open a circuit for metering purposes, current measurements can be made without service interruption by using a split-core transformer with the

By Chester M. Poor
Application Engineer
The Esterline-Angus Company, Inc.
Indianapolis, Indiana

recording instrument. One side of this is hinged so that it may be opened and placed around the conductor or bus.

The potential transformer functions on the same principle as any power or distribution transformer. Its power capacity is comparatively small, but its ratio of transformation is more accurate. The primary winding is designed for connection to high standard voltages; the secondary to supply 120 volt normal rating (150 volt maximum) for direct connection to instruments having potential coils rated at 150 volts.

The voltage rating of a recorder is often extended by means of a fixed resistance connected in series with the potential circuit. Such a series resistor is called a *multiplier*, because it multiplies the self-contained range of the instrument by a known factor. For example: a voltmeter has a scale range of 0 to 150 and a resistance of 10,000 ohms. By adding a resistance of 40,000 ohms in series with the instrument, the scale will read five times as much, or 750 volts. Series resistors are used both with ac and with dc voltmeters, ac wattmeters and other instruments to permit measurement of high potentials not safely applicable to the instrument proper.

Contrasted with series resistances which extend the voltage range of instruments is the shunt. This is a fixed, calibrated resistance placed in parallel with the instrument to increase its current range. Shunts are used on dc circuits, and are so constructed that they will have a constant resistance under all conditions.

Shunts of 10 amperes up to 10,000 amperes capacity are standard. Larger shunts can be provided. But for larger currents, especially above 10,-

000 amperes, it is most economical to use two or three smaller shunts in parallel. Large shunts should be installed with at least three feet of unbroken bus on either side. The blades should be vertical and there should be free access of air all around the shunt.

Due to the current drawn by the meter itself, a shunt and its leads are calibrated with the particular meter with which it is to be used. Therefore, when ordering a meter requiring shunts and leads, the purchase order should specify the type of mounting, the ampere rating of the shunts, and the length of leads to be used.

Chronograph Pens

Frequently it is desired to record the time or duration of events which are related to the quantity being recorded. This can easily be accomplished by attaching chronograph pens, one writing in each of either margin of the record chart. The pens are actuated by electro-magnets, which can be furnished to operate on either ac or dc voltage from two volts to 480 volts.

Recording Non-Electrical Phenomena

Recording instrument sensitivity can be greatly increased and non-electrical phenomena can be recorded by using suitable pick-ups and amplifiers. This is particularly true of the recording milliammeter. It can be made to record a wide variety of phenomena such as sound, vibration, speed, light intensity, color, moisture content, thickness, stress, position, frequency, intensity of ionizing radiation, and many other phenomena. In other words, wherever the phenomena to be measured can be converted to a proportionally small current, it can be recorded. Among amplifiers used for this purpose are those made by: The General Radio Co., Cambridge, Mass.; The Perkin-Elmer Corp., Glenbrook, Conn.; Weston Electrical Instrument Co., Newark, N. J.; Collins Radio Co.,

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STANDARD METER SOCKETS

Mount and wire the socket, then with a simple snap of the sealing ring the socket and meter are assembled. It's as easy as that.

Once installed, R-1 sockets can be forgotten. The stainless-steel sealing ring, plus the baked-on lacquer finish, combine to produce a corrosion- and weather-resistant assembly. Ask your G-E representative for full details. Or write for bulletin GEA-5147. Apparatus Department, General Electric Company, Schenectady 5, N. Y.



R-1 socket is easily mounted, has roomy space for wiring



Quick-hitch sealing ring requires no tools



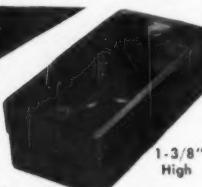
Socket with meter in place is sealed against the elements

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The UNION surface wiring line is designed to supplement not duplicate existing stocks.

Installed by standard wiring methods.

Eliminates the cramped and exacting wiring problems found in many surface devices.

Ideal for farm buildings, garages, attics, basements, etc. Listed by Underwriters, Inc. Approved by REA.



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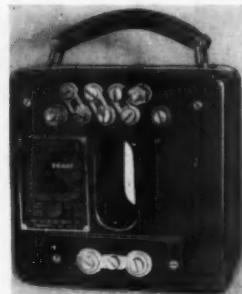


FIG. 5—Nine range, metal clad, portable current transformer for use with all types of alternating current instruments.

Des Moines, Iowa; Manning, Maxwell & Moore, Bridgeport, Conn.; and Millivac Instruments, New Haven, Conn.

Load Peaks and Power Factor

Today, when the law of supply and demand is beginning to come into its own again, all plant operators are looking for some way to increase earnings through the elimination of unnecessary waste. Every dollar of loss in power or labor, every breakdown or time loss on machines and processes, every defective piece of a product, affects the profit picture.

Many of these losses can be eliminated once the causes are known. Let's consider a loss caused by increased power demands due to unnecessary pyramiding of loads. Where power is purchased on a monthly demand basis, a single excessive peak load for one short period may fix a demand charge for that month.

Such a loss may be detected by installing a recorder in the main electrical circuit to make a complete record of the entire power load. The chart will show the time and frequency of power peaks. A study of plant operations should show why they occur and corrective measures can be taken. In a majority of cases, peaks are due to starting numerous motors at the same time. Solution, of course, is to stagger starting—particularly the larger motors.

Power Factor

Another industrial "headache" is power factor which might be called a measure of efficiency of use of electrical energy. It indicates what part of the total "apparent" power flowing in an ac circuit is real and useful power. The other component of the total "apparent" power is the reactive or so-called "idle" power.

Power factor affects the cost of supplying power. As power factor de-

LIGHTING FOR Plant Protection

**READY NOW! Complete, Up-To-Date Bulletin
to assist in making plants, areaways, loading
docks, etc. SAFE FROM ILLEGAL ENTRY!**

Today, every foresighted plant executive is going into action on the subject of better plant protection against all intruders and trespassers. As pointed out by civic defense leaders in current newspaper articles, all plants, and especially those engaged in work vital to defense, should take immediate steps to prevent espionage and sabotage.

One of the principal measures recommended is LIGHTING FOR PLANT PROTECTION. Experience has proved that one of industry's first defense lines against illegal entry is LIGHT. When industry wraps its property in the shining armor of protective lighting, it erects a barrier through which few intruders dare to pass. Moreover, protective lighting is of tremendous aid to guards and police as it creates a "no man's land" which can be easily patrolled and in which any suspicious person is instantly detected.

Benjamin Distributors are ready to assist you in the planning of protective lighting systems. By consulting them you draw on Benjamin's 50 years' experience in the manufacture of lighting equipment.

THE NEW BENJAMIN BULLETIN ON LIGHTING FOR PLANT PROTECTION brings you concise information to help you plan protective lighting for your plant areas. It contains complete data on Benjamin Lighting Units suitable for protective lighting and tells how and where to install them to fit the specific protective

lighting problems, found in the lighting of fences, areaways, buildings, as well as such vulnerable spots as spaces along railroad tracks, narrow alleys between buildings, yard entrances, and streets that dead end at the property line.

This informative Bulletin is yours without cost or obligation. It may be obtained from your Benjamin Distributor or by writing to: Benjamin Electric Mfg. Co., Dept. H, Des Plaines, Illinois



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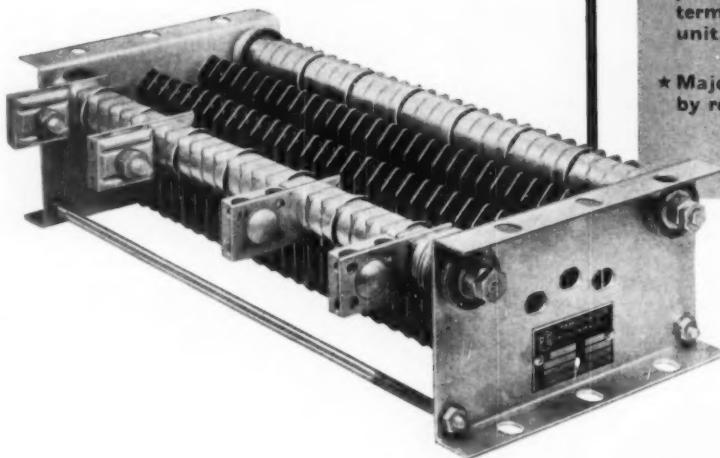
ELECTRICAL CONSTRUCTION AND MAINTENANCE OCTOBER 1950

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Little Effort Required To Make Adjustments

- ★ Minor variations often possible by wire change to other available terminals.
- ★ Greater variations easily produced by movement of terminal position in the unit.
- ★ Major variations effected by removal or addition of one or more standard banks.

Write for
BULLETIN No. 500E

OPERATING conditions change rapidly today. To meet new production schedules it may be advisable to adjust resistor layouts to do a better and faster job. P-G Standard Resistor Units already in use, and a few spares in the supply room, help in making needed alterations within a minimum time and with utmost efficiency. Normal adjustments can usually be accomplished within a few minutes. For minimum maintenance and maximum production, use P-G



The Nonbreakable Steel Grid Resistor

THE POST-GLOVER ELECTRIC COMPANY

ESTABLISHED 1892
221 WEST THIRD STREET, CINCINNATI 2, OHIO

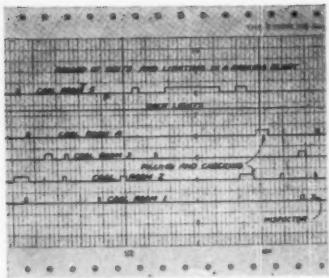


FIG. 6—Graphic record of inspector's visits to packing plant cooling rooms also shows when lights were turned on and off in rooms and loading docks.

parts from unity, the current necessary to carry a given load increases. Low power factor has the effect of reducing the effective capacity of both the generating and distribution equipment, requiring a higher investment per kilowatt of demand. It also makes each kilowatt of power carry a higher burden of line losses; increases transmission costs; increases voltage drop. The resultant lower utilization voltage may cause some production slump by making motors sluggish, dimming lights and slowing up heaters.

For these reasons, many power companies have incorporated into their rates, penalties for low power factor, or incentives for high power factor. Under power factor clauses, the customer benefits by reduced costs when he keeps the power factor of his plant high. Those plants which generate their own power, gain additional generator and transformer and line capacity with high power factor; reduce their cost of generation; and have better utilization voltage.

Since the investment in generating and distribution equipment and the losses in distribution are practically proportional to the values of current, regardless of the phase relation with voltage, the rational unit of demand measurement is the kilo-volt-ampere, and not the kilowatt. The direct measuring of kva on 3-phase circuits can be accomplished by interposing between the line and any standard 2-element wattmeter, a phase shifting network. This network supplies to the potential coils of the meter a voltage which lags behind the line potential by an amount equal to the lag of the current between the line potential. The current and potential within the instrument being in phase, it records kva directly. The wattmeter must have a potential range corresponding to the voltage of the circuit on which the combination is used.

Similar examples can be given for any factor or function of industry. Recording instruments have prevented

Here's Why Industry Uses SAF-T-LAG Fuses



Jefferson SAF-T-LAG FUSES

Provide New Wider Protection

Saf-T-Lag is needed today to protect motors and equipment, and insure against unnecessary shutdowns.

Saf-T-Lags protect against short-circuits and overloads, but prevent unnecessary shutdowns caused by harmless temporary overloads. Operating on the thermal principle they also protect panels, switchboards, and other electrical equipment in the circuit against damage due to excess heat caused by poor contacts.

Dependable protection is provided against motor burn-outs due to overloading and single phasing of polyphase motors. Because of less watt loss, there is a big saving in plants where many motors are installed.

Protect all electrical equipment and factory production with Saf-T-Lags.

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Wholesalers of Electrical Supplies**

JEFFERSON ELECTRIC COMPANY
Bellwood, Illinois

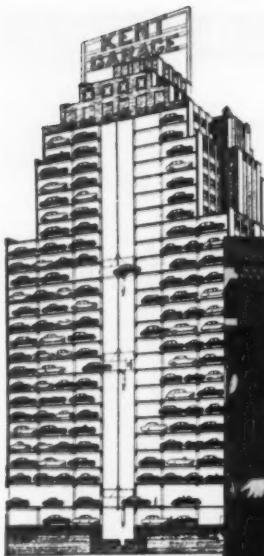


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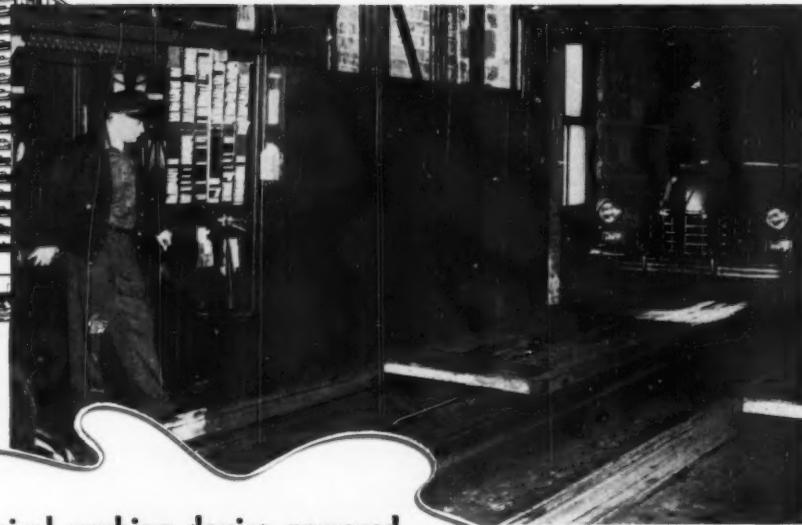


The Jefferson Extensive Line of Fuses includes:
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Cars parked...



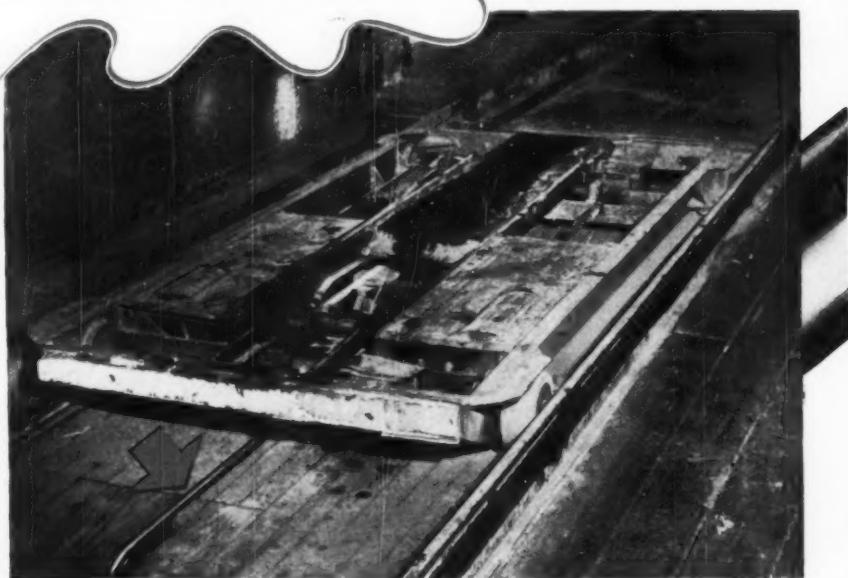
Cars are parked twenty-three high in this electric parking garage—and they are never touched by human hands until the owner gets back in.



Electrical parking device powered through flexible **AMERCLAD CABLE** moves cars on and off elevators.

Electric parker installed in elevator car holds car in position while the differential housing and pulls car back into elevator. Operator handles all controls from elevator.

Note the rubber-covered flexible Amerclad Cable that powers the three parker motors. This cable gets constant flexing over the pulley, must stand abrasion and oil droppings.



untouched by human hands

IN KENT ELECTRIC PARKING GARAGES

• At last you can have your car parked in a big city and get it back quickly without dents in the fenders.

The man who did something about the big city parking situation was Mr. Milton A. Kent from the small town of Kenosha, Wisconsin. He designed an electric parking garage based on the idea that the garage must be near the motorists' destination, quick and safe in handling cars, reasonable in price, and of good architectural design. Four of these garages are already operating in Chicago, Cincinnati and New York.

How they work

The heart of the idea is an electric parking machine used in combination with a high-speed automatic landing elevator. The motorist drives up in front of the elevator door, leaves his car in neutral with the brake off. The elevator operator sends the electric parker out under the automobile, raises a platform which bears against the car's differential and rolls the car onto the elevator without lifting it. The process is reversed in parking the car. At no time is the car driven by the attendant.

U-S-S Amerclad Electric Cable

SUPPLIES POWER TO ELECTRIC PARKER

Specially-built Amerclad Cable with heavy tire-tread rubber cover. Center section takes the strain from the reel. This design gave the best service of any tried.

THE electric parker is a low four-wheel machine driven by electric motors. It scoots out from the elevator like a spider, grabs a car and hauls it back in.

A flexible Amerclad Cable on a reel supplies power to the parker. This cable takes a terrific beating. It is dragged over the concrete floor, picks up oil and is constantly reeled and unreeled over a small pulley. Various cables were tried and Amerclad was finally chosen because it gave the best service for the least cost.

Amerclad Cables for extremely severe service like this are especially designed. They are heavier than usual and have a thick cover of tough oil-resistant Amerprene rubber which wears like tire treads.

This is an unusual and limited application but it illustrates how our engineers can help you solve difficult cable problems. They have developed cables with many different rubber formulations—including conducting rubber for shielding and rubber for underground cables such as are now approved for airport use without conduits.

Write for our new 64-page book on U-S-S Amerclad which describes all types of rubber-covered cables and shows where each type should be used.

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AMERCLAD CABLES

UNITED STATES STEEL

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to
OSTER OSTER**

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Oster No. 582 "TOM THUMB" is built to give you top quality threading at low cost. Spindle, shafts and worm are mounted in **BALL BEARINGS**. That assures uniformly smooth power without friction. Other features make this the fastest portable threader on the market. In addition . . .

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Automatic
in gripping
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The NEW front chuck
that revolutionizes
chucking.

A quick spin of the "Auto-grip" hand wheel brings the powerful chuck jaws in contact with the pipe. Then the operator starts the machine. The jaws grip the pipe automatically. The **TOUGHER** the pull—the **TIGHTER** the grip! You get easier, faster, safer chucking with "Auto-grip".

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No. 422 POWER VISE STANDS

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Liberal allowance on your present chuck.
Ask your Oster Distributor or write us.

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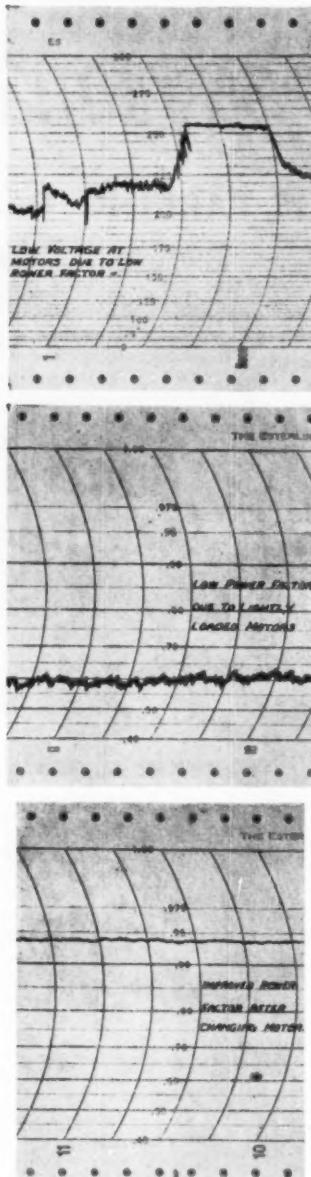


FIG. 7—Voltage and power factor records in metal working plant. Chart at top shows low voltage at full load; center, low plant power factor; bottom, high plant power factor after correcting motor conditions.

loss of money and equipment by foreseeing a defective machine; by proving that a machine was idle too long a time; by showing that a bottleneck existed and caused delay in a specific process; by being a silent time-study man; by showing defective material;

and by aiding in the correction of power factor.

Application Case Studies

Graphic instruments frequently enable modern maintenance staffs to discover impending trouble before breakdowns occur in the electrical system and production machines themselves. Such Preventive Maintenance Programs demand a degree of foresight, considerable planning and a periodic check of each item of equipment subject to wear and tear.

By connecting electrical recording instruments in the circuits, maintenance supervisors and plant management can obtain charts which may throw light on many plant operations which formerly escaped notice because they were not apparent from ordinary operation. A few actual application case studies will illustrate the point.

Detecting Current Waste

A large southern packing company experienced continual difficulty in getting workmen to remember to turn off lights when they left refrigeration rooms. This tendency led to a triple loss: lamp life was reduced, current was wasted, and undesirable heat was liberated inside the refrigerators.

A six-pen graphic time recorder was installed, wired for zero line indication when the current in the room was off. Records were kept for each of the five refrigeration rooms, and one for the dock lights which sometimes were overlooked. A section of the chart from this instrument is shown in Fig. 6. The short periods with the lights on were made when a workman entered to check temperatures. The longer periods show when men entered to load the coolers or to check the amount of meat in them.

Management of this company asserts that this instrument has paid for itself many times through savings effected, and has induced the men to be more careful in all their work.

Power Factor Correction

A large metal working plant, which had grown steadily, was having trouble. As departments were added or enlarged, induction motors of ample capacity were added without regard to their effect on the plant power factor. Eventually some motors were having starting difficulty, feeders were running hot, and motors were even burning out occasionally.

When told to find and eliminate the cause of the trouble, the plant engineer used three graphic meters to arrive at a solution. He used a wattmeter, a voltmeter, and a power factor recorder. Three of the survey charts are reproduced in Fig. 7.

The recording voltmeter, connected

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Appearance Isn't everything. The price tag isn't the whole story. *Lighting is a science.*

It takes the right equipment, certainly. It also takes expert planning in the application of this equipment to give you the **BEST BUY IN LIGHTING**. You know that, of course, but how many others do?

Good lighting, combined with practical economics, takes the services of a qualified lighting engineer.

Whether you plan lighting, buy lighting or install lighting, ask for the services of a Westinghouse lighting engineer. J-04283

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**Powerful
Dependable**

ELECTRIC HAMMERS

3600 power-packed punches per minute knock down high costs of drilling, cutting and chipping in concrete or masonry.

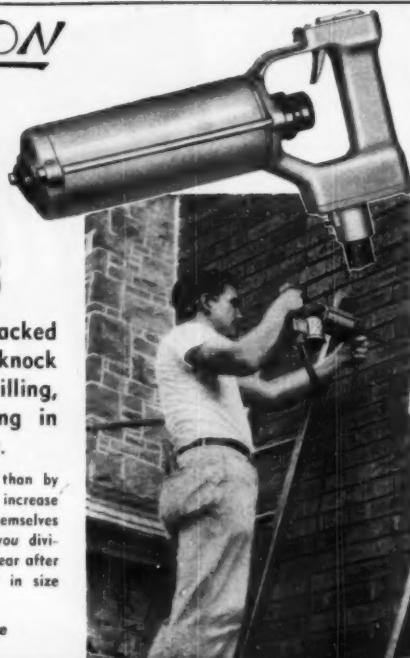
Do jobs ten times faster than by hand . . . reduce fatigue . . . increase profits . . . quickly pay for themselves . . . then keep on paying you dividends on job after job, and year after year. Six models—all small in size but big in power.

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*Carry WATER, GAS
AIR LINES, CABLE
at any angle to beams*

On open steel construction, Efficiency "Type F" Conduit Hangers are your best choice for carrying $\frac{1}{2}$ " to $2\frac{1}{2}$ " pipe and armored cable. Patented radiating ridges and 5-point gripping surface keep pipe and cable suspended dead center, permitting it to be carried securely at any angle to the beam. Write today for Catalog 38-A.



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"EFFICIENCY"
CONDUIT
HANGER
"TYPE F"

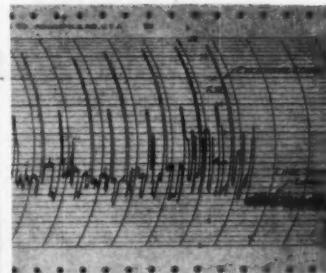


FIG. 8—Excessive load peaks on 35 hp. motor driving stone planers. Chart detected trouble in one of the planers. Subsequent preventative maintenance measures prevented serious breakdown.

at points on the power circuits where motors were giving trouble, showed that the load was light at noon and the voltage was 255. However, when the entire plant was running, the voltage at the motors dropped as low as 200 volts.

The power factor meter showed that the power factor averaged 60 percent. Here was an obvious clue to the cause of the difficulty.

Then the wattmeter was used to make a systematic survey of all electrical equipment in the plant. Under-loaded motors were replaced by units of proper size. Several large induction motors were replaced by synchronous machines. When the job was completed, the trouble had disappeared, power consumption had actually decreased, and plant power factor had been raised to 93 percent.

Preventive Maintenance

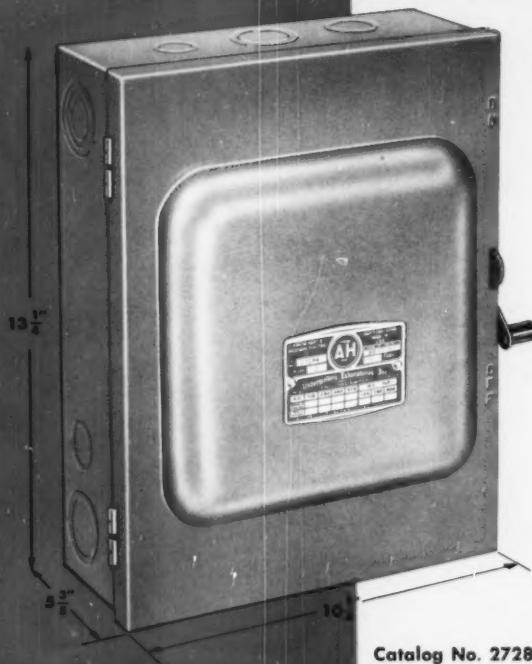
Every machine, when in prime condition, has certain characteristics of operation. Any departure from normal due to any one of a variety of causes, such as broken or worn out parts, settling of foundations or excessive friction, will change the character of the graphic record, disclosing a situation which requires attention.

The graphic record in Fig. 8 was made by a wattmeter in the supply circuit of a 35 hp motor driving four large stone planers. On this chart appears something which had never occurred on previous charts from the same equipment. At regular intervals, the power consumption rose to a peak more than twice normal.

By shutting down one machine after another, the maintenance engineer quickly located the machine which caused the high peak. He watched the instrument as the machine was operated; noted that the peak occurred at the moment of reversal. When the machine was shut down one part of the reversing mechanism was found



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*Quality Engineered
FOR
Dependable Duty*

- SUPERIOR SAFE PERFORMANCE
- QUICK MAKE-&BREAK TYPES A and C
- SAFE, EXTRA STRONG BOX
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- RANGE of TYPES "A", "C", "D", "CR" and SERVICE EQUIPMENT

Catalog No. 27284 Type "A" — 3 Poles, 3 Fuses, 575 V.A.C., 7½ H.P.

Whatever factors contribute to superior switch performance—whatever factors add extra safety, or greater dependability, or longer life—they're all built into Arrow-Hart's line of Enclosed Switches. Arrow-Hart designers and engineers planned with precision, basing their work on the wants and needs of industry when they built the A-H switch.

Not a weld, not a seam, not a screw, nor any part has been treated carelessly or haphazardly or negligibly in this A-H product. You will be convinced of this when you see and use the Arrow-Hart Enclosed Switch—more convinced yet when you've come to put your trust in its performance in your plant. For a discussion of some of its outstanding features, see the reverse page.

CONTROLS and APPARATUS
FOR *Outstanding*
PERFORMANCE



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103 HAWTHORN ST., HARTFORD 6, CONN., U. S. A.

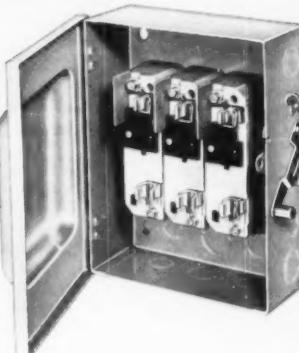


ENCLOSED SWITCHES

THE RIGHT UNIT... BUILT RIGHT... RIGHT FOR THE JOB

SAFE, STRONG ENCLOSURE

The box is made of heavy gage steel; finished with special-formula chip, abrasion, and heat resistant enamel, baked on by infra-red heat for better bond, smoother and more durable surface; welded, extra-overlapping seams add to rigidity, provide extra protection against dust and moisture; knockouts removed easily, cleanly, due to pre-piercing—yet do not dislodge accidentally, due to flush stamping and paintlock. Type "A" switches cannot be opened in "ON" position. Wiring and servicing are simple—plenty of knuckle room in the box.



SAFE, STURDY, DEPENDABLE MECHANISM

Actuating handle and mechanism virtually unbreakable under normal conditions — zinc finish prevents rust. Actuating spring provides quick-make, quick-break action—extra strong, extra safe, semi-selfspringing for positive contact. Contacts are tin dipped copper, can carry the heavy loads for the long pull. (In certain sizes, contacts are enclosed in separate porcelain chambers which confine arcing.) Switches designed to operate under continuous load. Arrow-Hart makes all parts—enclosures, contacts, operating mechanism, porcelain—to assure you of a quality product, long lasting and satisfactory on every count.



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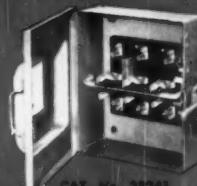
Whatever your requirements in an enclosed switch, Arrow-Hart can supply the unit to do the job. With the most extensive line in the field, Arrow-Hart also offers the latest improved designs, and possesses the know-how to produce special switches for extraordinary applications. Below are three representative standard types.

ALL ARROW-HART ENCLOSED SWITCHES ARE LISTED AS STANDARD BY UNDERWRITERS' LABORATORIES.



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Type "D" general purpose. Fusible and non-fusible available. 30 Ampere sizes for plug fuses. 30, 60, 100 and 200 Ampere sizes for cartridge fuses. Also with Dead Front Shield, Meter Trim and walls — Painttight.



CAT. No. 29241

Type "A", heavy-duty, double-throw, with interlocking cover. Fusible and non-fusible, 200 or 600 Volts, 30, 60, 100, 200, 400 and 600 Ampere sizes.



CAT.
No. 27162

Pull-out type service equipment. Bakelite interior, main range pull-out. Surface or flush mounting. Available for series or parallel wiring, 4, 6, or 8 branch circuits, and for 4 circuits, rain-light or weatherproof installation.

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CHAMPION DEARMENT TOOL CO.

Meadville, Pa.

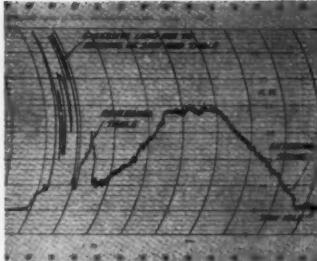


FIG. 9—Load chart on stone mill circular saws showed that excessive peaks occurred when saw was withdrawn from cut. Realignment of saw carriage eliminated peaks and damage to diamond setting in saw teeth.

broken. In all probability, the machine would have been run until a breakdown occurred, since the defect could not be detected by casual observation.

In the same stone mill, structural and ornamental shapes are finished in long lengths by planers and then sawed to exact lengths by means of circular saws with diamond sets in the points of the teeth. Some difficulty had been experienced in keeping the diamonds in the saw teeth.

A graphic wattmeter, placed in the circuit of the motor driving the diamond saw, produced the record shown in Fig. 9. The load was normal when the saw was idle and while cutting through the stone. The engineer was surprised to find that the motor load was heavier when the saw was being withdrawn; also that the load fluctuated widely.

Investigation revealed that reversal threw the saw out of line in the cut, causing a binding action as the saw was withdrawn. With this clue, the maintenance department realigned the machine and eliminated the dislodging of diamond settings before permanent damage was done.

In similar cases, graphic meters have shown defective gears, defective operation of spot welders, defective alignment of crane rails, defective air compressors and other non-electrical ailments.

Numerous examples could be cited where use of graphic instruments led to substantial savings. Industrial plants have discovered waste of current through grounds by installing center-zero graphic voltmeters on switchboards; thousands of dollars have been saved through the discovery of power wasted in unnecessary friction losses; and plant efficiency has been increased by checking distribution voltages.

Don't Miss
READER SERVICE page 99

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THE HENRY ELECTRIC COMPANY
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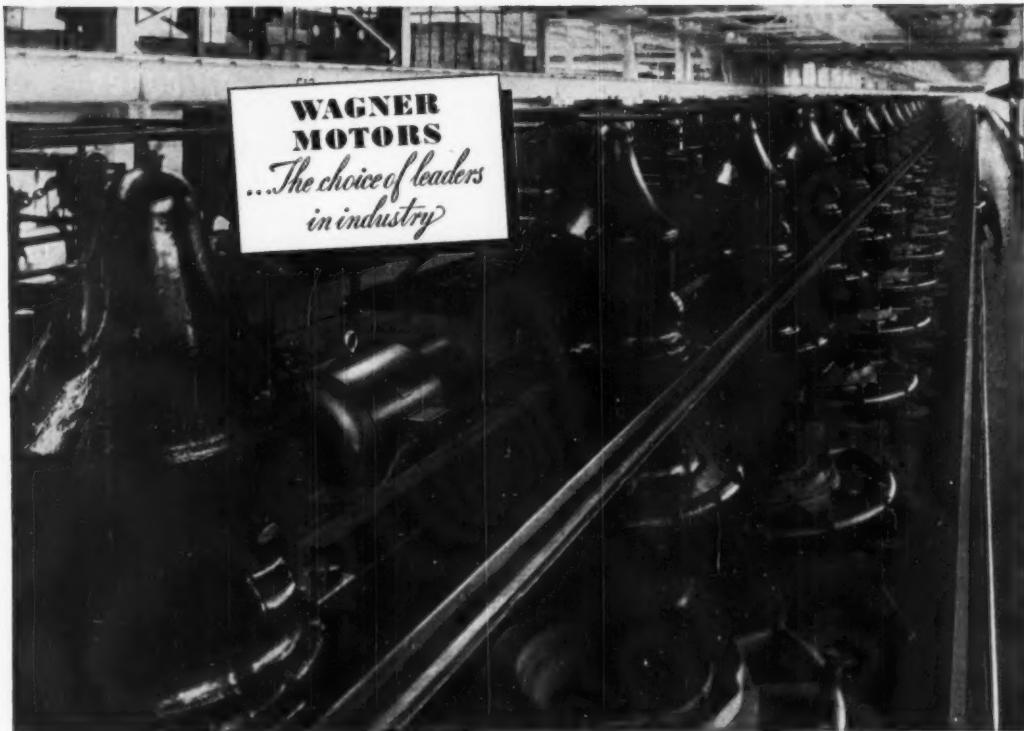


Plate glass polishing for Ford demands polished motor performance

Polishing the clear, safe-vision glass that is turned out in the Ford Motor Company glass plant at Dearborn, Michigan, is a big job. Huge lines of these 60 grinding and 100 polishing machines, which are so delicately aligned that they compensate for the curvature of the earth, are in daily 24-hour operation. This calls for polished performance . . . perfect, dependable service . . . on the part of the motors that power the tireless machines. It is significant that a battery of Wagner 40-hp type CP totally-

enclosed, fan-cooled motors are used at this rigorous application.

For *your* requirements . . . there is a Wagner motor to answer every need for a standard type of electric motor in sizes from 1/125 hp to 400 hp . . . a complete line for all current specifications, with a wide variety of enclosure types and mountings.

Wagner engineers are qualified to specify the correct motor for your needs. Consult the nearest of our 31 branch offices or write us.

Continuous, unfailing power for the Ford plant grinding and polishing machines is furnished by Wagner 40-hp type CP, 445 frame, 1200 rpm. motors. There is a specific motor equally applicable to your exact need in the complete line of Wagner standard motors.



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AUTOMOTIVE BRAKE SYSTEMS — AIR AND HYDRAULIC

BRANCHES IN 31 PRINCIPAL CITIES

Motor Shops

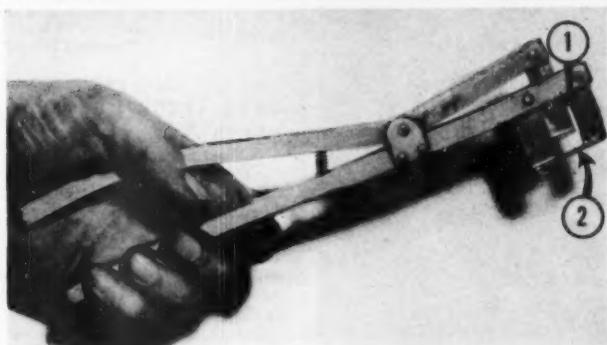


FIG. 1—Slot plier has movable hinged jaw (1) which rises against slot flange; and stationary tamping jaw (2) which presses against coils when handles are pressed together.



FIG. 2—Tamping coils and insulation spacer in large motor stator with slot pliers. Same tool can be used to tamp second coil in slot preparatory to inserting slot wedge.

Slot Pliers Tamp Stator Coils

Seating coils in stator slots is sometimes a laborious chore, particularly if the motors are of the smaller sizes. The conventional mallet and fiber strip cannot be used effectively. One solution to this problem was devised by T. A. Heermans, co-owner of the F & H Electric Company, motor service shop at Dallas, Texas.

Heermans designed and patented a slot plier with four sets of detachable jaws which successfully tamps coils in motors ranging from $\frac{1}{4}$ hp to 20 hp in size. With this device the operation can be done with one hand.

Features of the pliers are simple construction and operation. Two 10-inch long handles are hinged near the working jaws and held in position by a coil spring (see Fig. 1). Mounted

to the end of the lower handle is a stationary, dual-element, flanged, tamping jaw. Riding in an opening in this lower jaw, and fastened to the end of the upper handle by a pin hinge, is a single movable element.

When using the plier, the operator inserts it into the stator slot in the closed position (jaws closed). As the handles are pressed together, the hinged jaw rises and engages the stator slot flanges. At the same time the lower stationary jaw is pressed down on the coils in the slot (see Fig. 2). By repetitive operation as the plier is moved along the length of the slot, coils can be tamped into place in a few seconds. Mechanics in the F & H shop prefer this device to the mallet and fiber strip even on larger motors.

Folding Turntable For Wire Measurement

A turntable that can be lowered to lie flat against a shop wall or raised into a horizontal plane is used as an aid in measuring wire in the store room of Vaughan Electric Service, Los Angeles, California. The table top consists of a circular steel plate revolving on a ball bearing pivot and slotted so that guide rods can be positioned at varying distances from the hub. Guide rods are moved in or out along these slots and are held firmly in the desired positions by means of easily adjusted thumb screws.

The table is supported by a triangular frame which is hinged to the side of a steel storage bin. The frame can be swung up and out or down and in. When in the up position, a brace, pivoted from a lower position on the bin's side, holds the frame steady.

When it is necessary to unwind wire from a large reel, the reel is placed on the turntable, the guide rods are adjusted for the proper inside diameter of the wire reel, and the wire is wound off as the turntable revolves.

There is one objection to the present construction. That is the fact that, when the table is lowered flat against the bin, the guide rods protrude from the wall and the possibility exists of someone scraping an ankle or tripping. This can be eliminated by unscrewing the guide bars whenever the table is not in use, but Vaughan is considering the faster solution of cutting slots in



REVOLVING TABLE can be raised into a horizontal plane or lowered flat against the wall of a storage bin. When up, the table is supported by an adjustable metal frame. Guide bars can be adjusted to hold any size of wire reel.



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the storage bin wall above the table. Under this contemplated solution, the table would be raised out of the way rather than lowered, the guide bars would slip through the slots and be out of the way, and the table would be held against the bin by means of a small spring latch.

Shop Truck For Large Armatures

Shop efficiency is one of the prime operating goals of the Koontz-Wagner Electric Company in South Bend, Indiana. Hence, shop supervisors are always devising new ways of performing motor repair chores and eliminating the drudgery in heavy equipment handling problems.

One of the latest developments of shop superintendent E. R. Pearson is a dual-purpose shop truck equipped with rollers to handle large rotors. The unit can be used to move heavy armatures about the shop and also for rotor inspection and welding operations when necessary. No longer need armatures be hoisted on slings or cradled in floor stands.



ROLLER CRADLE on low shop truck simplifies and speeds up handling, inspection and repair of large armatures.



ARMATURE RESTS on heavy rollers on truck base; can be rotated for inspection or welding repairs. Contact fingers keep rotor from rotating.

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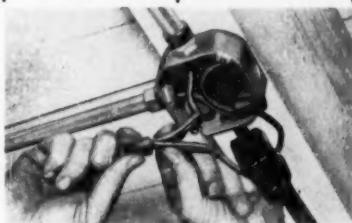
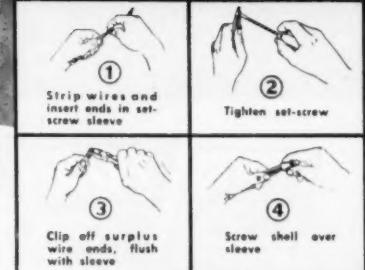
Two contractor sizes, listed by Underwriters' Laboratories, Inc. for wire combinations from two No. 14 through five No. 14, two No. 10 and one No. 12 and many others.

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Use Mica-Glas, and other National insulation, for known high value. Some of the world's largest manufacturers of electrical equipment standardize on it.

In the illustration above, Mica-Glas is being visually inspected and gauged for correct thickness. Bond content, dielectric strength, slippage and other characteristics are very carefully checked during manufacture and as a final inspection before shipment.

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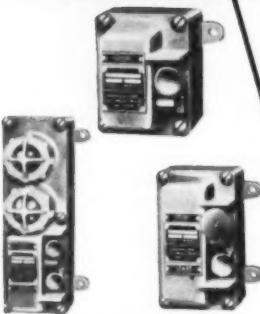
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Precision-Built Electrical Equipment

125 BARCLAY STREET, NEW YORK 7, N. Y.

The roller assembly consists of two 18-inch lengths of 4-in. T-irons welded to the base of a low shop truck. Two 34-inch diameter metal rollers (each 20 inches long) on nine-inch centers are mounted between these supports. Rotors are cradled in the rollers and can be rotated if desired. To keep the rotor from rotating too freely, friction brakes are attached to each roller. These consist of old contact fingers (similar to those on drum controllers) mounted by spring metal to the base at each end of the roller.

Koontz-Wagner mechanics like the idea; find that it reduces equipment handling time considerably and adds materially to the flexibility of rotor inspection and repair operations.

Portable Stripper Cuts Winding Costs

A portable wire stripper that can be taken to stators and armatures is cutting costs at the Kato Engineering Company, electrical machinery manufacturer at Mankato, Minnesota. Developed by C. H. Jones, president of the firm, the new stripper has cut labor costs as much as 25 percent on machines with numerous multiple-conductor coils.

Powered by a small motor, the stripper is suspended from a boom by a counter-weight pulley arrangement so it can easily be moved up or down to reach stators of various sizes. When used over benches on armatures, the unit is suspended from a monorail track.

The stripping head, containing the



PORTABLE STRIPPER with compact head and suction attachment can be lowered into stator for access to coil ends. Unit has counter-weighted suspension.



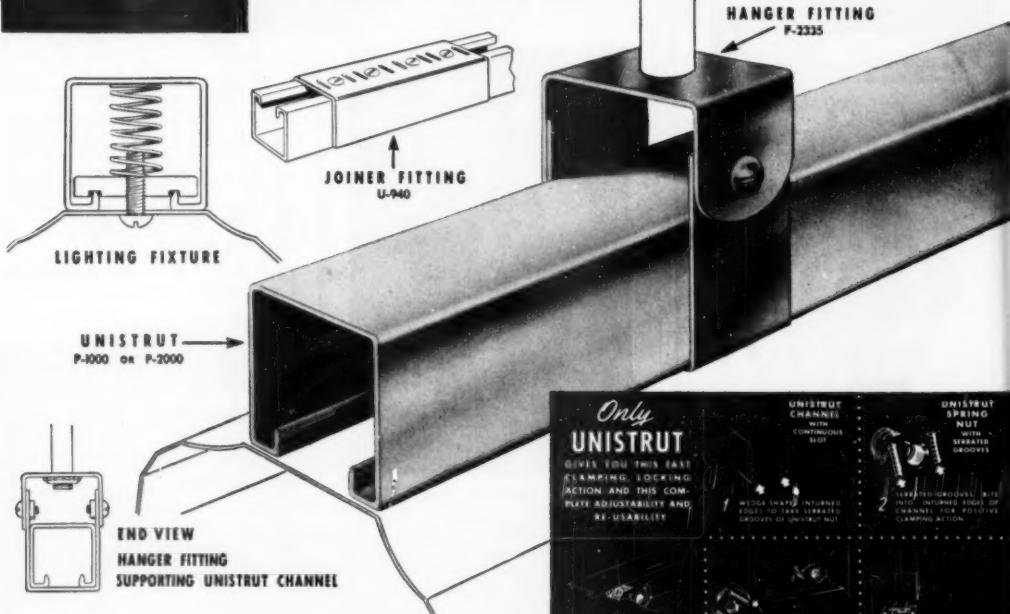
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No. 275 One Hole Strap for oval-shaped cable.



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No. GR-1 Grounding Ring.
For bonding meter box to artificial ground.
Tight connection and positive bond without soldering.



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BOOM SUSPENSION with counter-weighted pulley arrangement provides high maneuverability of stripper in stator winding department

revolving brushes, is compact enough to permit access to coil ends in the confined areas of the stator; has a suction attachment to remove the cotton lint and enamel particles stripped from the conductors. Each stripper serves two winders and has a foot-switch for convenient control.

Vacuum Motor For Gas-Fired Burner

Burning out old coils from motor slots, melting solder and applying heat to local areas is facilitated in the shop of the California Electric Company, Oakland, Cal., by a gas-fired burner designed around the electric unit of a vacuum cleaner. Connected so that air is blown through a concentric tube, the motor is controlled by a rheostat

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76% with a
KETT
TALL REACH WOOD BORER

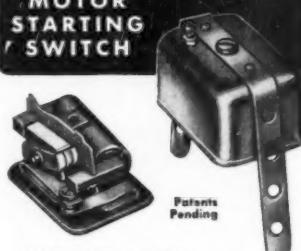


In a contractor's test, using hand brace and bit and ladder, average time for a hole was 21 seconds. With the KETT "Tall Reach" Wood Borer, same hole took 1 second! This means you can do a four-day job in one day, with this amazing tool.

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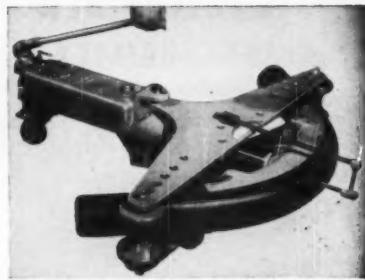
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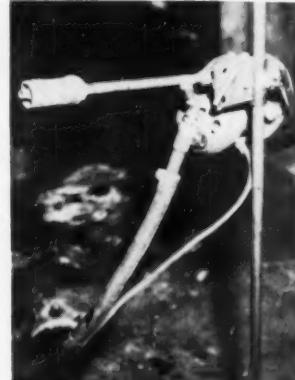
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that regulates the speed and the volume of air passing through the tube. Gas passes through the center section of the concentric tube, while the gas volume is adjusted by a hand knob at the point of supply. By varying the volume of gas and the speed of the motor, the combustible gas can be regulated for a wide variety of flame intensities.

This assembly is mounted on a pipe stand, with a clamp to fix the burner at any desired elevation and a pivot and thumb screw fixing the vertical angle of the nozzle. In this manner, the flame can be directed in any desired direction and any required height.

At the tube's end, the burner nozzle is expanded, with the middle or inner tube perforated. This permits gas and air to partially mix before leaving the burner, it increases the flame area and maintains a constant flame. While coils are usually burned in one of the shop ovens, this small gas-fired unit has been useful in numerous ways for applying local heat to small areas or for short intervals.



MODEL SLOT FORMS are used in the shop of Lima Armature Works, Inc., Lima, Ohio, to carefully check size of coils made for on-the-site installation in large motors. Form shown is made of 1/2-in. thick wood with 2-in. by 4-in. spacers; has eleven slots; was built to check coils rewound in the field.

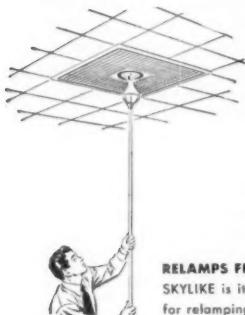
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SKYLIKE is good news for electrical contractors, because it has the advantages of simple wiring, light weight and fast installation, and complete freedom from service call-backs.

In addition to all its technical advantages, SKYLIKE is modern, handsome, and versatile in application. Units fit 24" x 24" ceiling tiles, fully or partially recessed, or may be surface-mounted—in rows or patterns. With a simple accessory and a semi-silvered-bowl-lamp, SKYLIKE is converted for directional or accent lighting.

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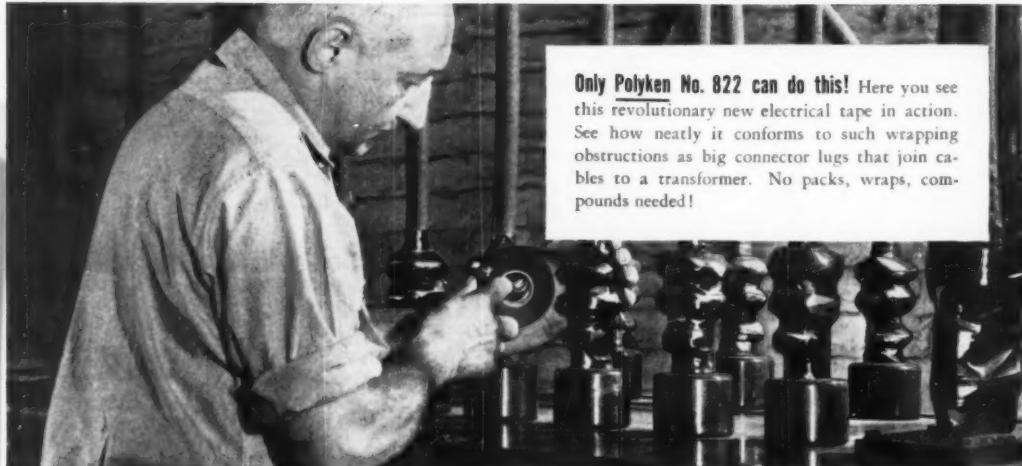
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Now wrap high-tension cables in ONE easy step!

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No. 822 is the only oriented polyethylene tape with a successful pressure-sensitive adhesive. Stretches both ways, so that it covers rough and irregular surfaces. High moisture resistance. Solvent proof. Corrosion proof. For splicing, wrapping, insulating, corrosion coating of cables, wires, controls, pipes, conduits, and hundreds of other uses. Write for free samples today!



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In the News

Washington Roundup

The Defense Production Act of 1950, giving President Truman power to impose wartime controls on the economy, was authorized by Congress and passed into law early in September. Few controls and directives under these new powers are expected before 1951, however, and such controls as may be issued this year are not likely to be very tough. In 1951, after defense production orders get underway throughout industry, controls will be established wherever needed to keep war materials flowing from production lines according to schedules.

First big job of the Administration has been to set up and staff the organization required to carry out the terms of the defense production act. Mr. Truman's first action was to appoint W. Stuart Symington, who heads the National Security Resources Board, as "co-ordinator" for defense production, and to parcel out DPA controls authority to the heads of old-line government departments. Those delegated controls authority, and made claimant agencies for critical materials along with the defense agencies, and the products which they will control, were:

Secretary of Interior—electric power, fuels and petroleum,

Secretary of Agriculture—food, and the distribution of farm machinery and fertilizer,

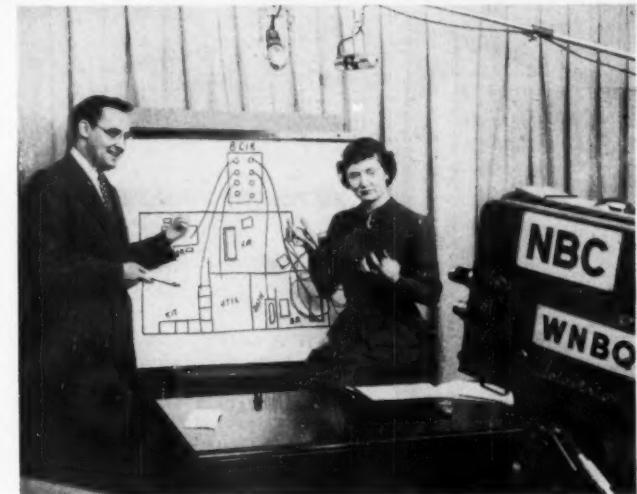
Interstate Commerce Commission—transportation, storage, and port facilities,

Secretary of Labor—nation's labor supply,

Federal Reserve Board—consumer and industrial credit, and

Secretary of Commerce—manufacturing, distribution, and service industries.

Electrical construction and maintenance industries will be most affected by control regulations and directives issued by the newly created National Production Authority within the Department of Commerce. Its first order (NPA Reg. 1, Inventory Control, issued Sept. 18, 1950), established inventory limitations on a number of materials already in short supply—including building materials, chemicals, forest products, iron and steel, metals and minerals, rubber, and textiles. Another order expected shortly from NPA will give priority to military contracts throughout industry. The inventory control order will have



PLUG AW ON TV—Chicago telecommentator Clint Youle explains advantages of Adequate Wiring to his wife Jeanne on Electric Association television program. Chart talk is part of 13-week TV series (two 15-minute periods per week) on Adventures in Electrical Living. Directed primarily to 3,000 electrical dealers in Chicago area, the program covers fundamental operation of appliances; also reaches about 400,000 housewives during afternoon lull; is part of the Electric Association's educational activity.

little effect on industry, as shortages of the materials under control (and high prices) are already accomplishing the results intended by the order.

Biggest headache facing NPA is the problem of staffing to handle even routine business. Wm. H. Harrison, on leave from I. T. and T., is the new Administrator. He has appointed H. George Wilde, New England businessman and farmer, as assistant; Manly Fleischmann, general counsel; W. Howard Chase, public relations director for General Foods Corporation, as consultant and information man; and H. B. McCoy, Director of the Office of Industry and Commerce, Department of Commerce, as Assistant Administrator for Industry Operations. Other appointments are being made as qualified persons willing to serve can be found.

Harrison's first moves were to call meetings of the leading steel and copper producers, to discuss industry problems, programs for expansion of production, and to study plans for future allocations and controls of these metals.

In the meantime Commerce Secretary Sawyer has established as part of his NPA and *Advisory Committee on*

Priorities Administration. Idea behind this committee is that about every agency that has an interest in priorities and allocations will be represented on the committee, whose job it will be to consider military, civilian and foreign requirements of critical materials and to recommend programs for the production and allocations of these materials.

There is no indication at present that the controls program will be rushed, but rather that it will be put into effect gradually after careful study of military and civilian requirements alike.

New building construction continues to forge ahead. A record \$4.4 billion will be spent on plant expansion and modernization during the last six months of this year by manufacturing companies alone. Gas and electric utilities will spend nearly \$3.2 billion this year, a new peak exceeding 1949 by \$30 million. Total 1950 construction is now expected to reach \$17,870,000,000, approximately 1949's total.

In August new dwelling units started totaled 141,000 down only 3000 from July, 1000 from June. Total starts for the first eight months of 1950 is 988,400, according to estimates of the La-

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1 S-412 ½" HOLE-SHOOTER, ball and roller-bearing equipped . . . Jacob's geared Chuck . . . 450 R.P.M.

2 #Two-Speed "Right-Angle-Drive" attachment . . . low side, 300 R.P.M., . . . high side, 675 R.P.M.

3 3 special bits for boring in wood— $\frac{1}{4}$ ", $1\frac{1}{8}$ " and $2\frac{1}{8}$ ".

4 Special wrench for attaching and adjusting "Right-Angle-Drive" and Chuck.

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QUALITY TOOLS



S. I. JAGGAR and Arthur I. Tobey, Jaggar-Sroufe Company, Portland, Oregon, check specifications and blueprints for one of their recent projects—the modern new National Biscuit Company plant.

bor Department's Bureau of Labor Statistics.

Impact of materials shortages will begin to be felt by early 1951 in the construction field, as actual defense production gets more fully under way. But industrial and other essential construction will be encouraged—by priorities and allocations, and by Federal aid in the form of guarantees to financial institutions against loss on loans, and in the form of direct government loans to private enterprise by Reconstruction Finance Corporation. Such aid will be considered for expansion of capacity, development of processes, and production of essential materials.

Structural standards for bomb shelters are being developed by NSRB. The Civil Defense Administration, set up as an interim measure by Truman's executive order within NSRB, indicates shelters should be provided in critical target areas which have been determined to be the most likely objective of attack. There are 140 such areas, according to the civil defense planners. Just how much electrical construction will be required in these projects has not been indicated. Financial responsibility for such shelters must be shared by Federal, State and local authorities.

As building construction tapers off in non-industrial fields, as it is now expected to do, two major markets should open up for electrical contractors. Biggest will be the electrical modernization market in existing industrial plants—installation of greater electrical capacity, and of flexible distribution systems to meet stepped-up streamlining of production lines. Next biggest market will be industrial plant electrical maintenance—keeping electrical systems from primary supply to utilization outlets in first class operating condition at all times.

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SYSTEMS



HAND SETS

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DESK-WALL
SETS

Manpower shortages are already being felt—in industry, commerce, on the farm, by the military and in government. As one government official expressed it, "Zinc and copper are in critically short supply, but it is practically impossible to hire a good secretary." This problem is getting tougher fast, and will increase as the national defense program continues to pick up speed. Here, too, electrical construction and maintenance organizations should appraise their future labor requirements and see that adequate trained manpower will be available, when and where needed.

Secondary Boycotts

Serious doubt has been cast on the ability of Taft-Hartley's secondary boycott ban to stop a common tactic of building trades unions on construction projects.

In a unanimous decision, the U. S. Court of Appeals in Washington, D. C., has ruled it is not a secondary boycott when union men strike to keep non-union employees of a subcontractor off the job.

This decision conflicts sharply with at least three others in other Appeals Courts. All four are headed for the Supreme Court for clarification as to just what section 8B 4A means in this type of situation.

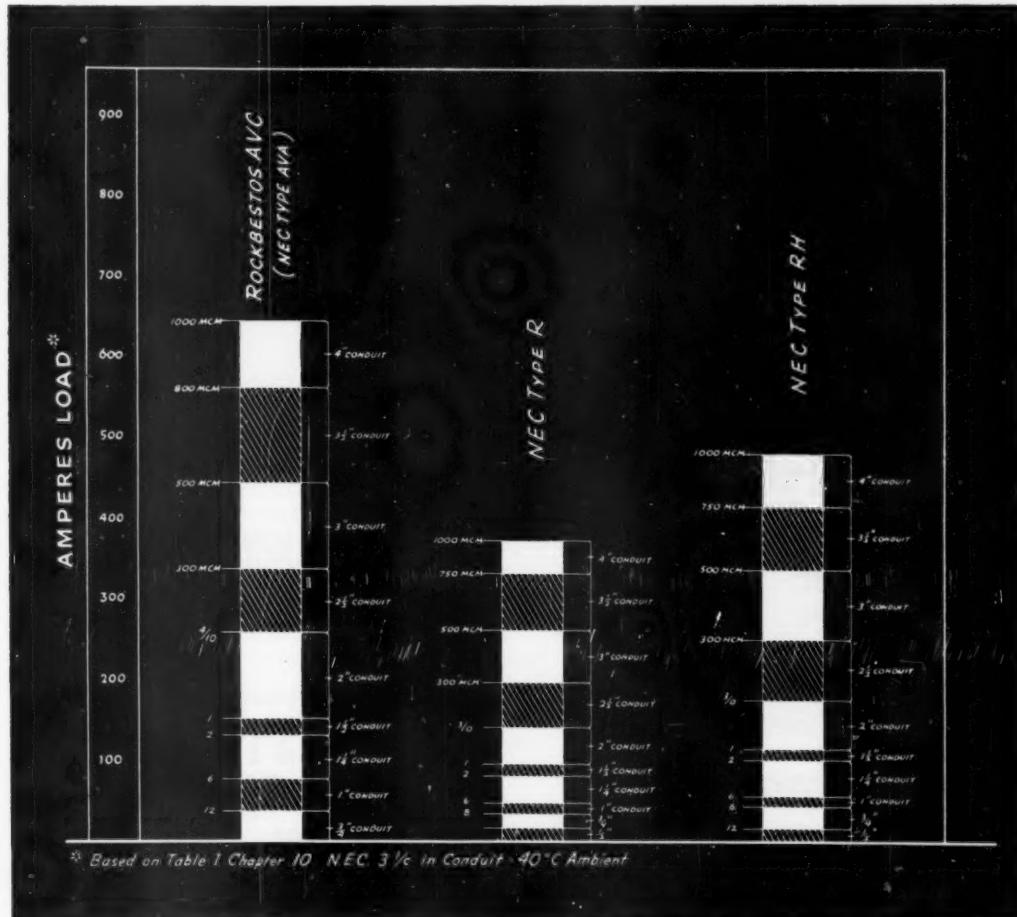
Here is the problem. Roughly, this secondary boycott section makes it an unfair labor practice for a union to strike, or urge others to quit work, if the purpose is to force any employer to stop doing business with another.

In the case just decided, the Denver



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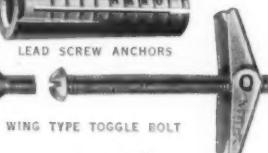
STUD BOLT ANCHOR



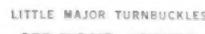
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LEAD SCREW ANCHORS



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— SEE YOUR JOBBER —

ARRO EXPANSION BOLT CO.

1540 BOONE AVE. MARION, OHIO

Building Trades Council and the AFL Electricians and Plumbers locals picketed and struck a job of Doose & Lintner Construction Co. in January, 1948. They picketed the job as "unfair" because of non-union men brought on the job by an electrical subcontractor, Gould & Preismer.

Doose & Lintner charged the union with committing a secondary boycott. NLRB General Counsel Robert N. Denham's office issued a complaint against the Council and local unions. As required by Taft-Hartley in secondary boycotts, an injunction was sought. The Federal district court refused the injunction on the ground that the construction job was purely local and not subject to the jurisdiction of the law. After two weeks, the non-union workers were replaced with union men and the dispute was ended.

Meanwhile, the secondary boycott unfair labor practice charge was prosecuted through NLRB. The Board decided (1) that it had jurisdiction, (2) that the lower court's rejection of jurisdiction as to the injunction had no bearing on the Board's right to prosecute the unfair labor practice, and (3) that the labor organizations were guilty of committing a secondary boycott.

The Court of Appeals split two to one in upholding NLRB on the first two parts of the decision, but was unanimous in its opinion that the unions had not violated the secondary boycott section of the Taft-Hartley Law.

NECA Convention Program

"Progress Through Efficient Management and Training" is to be the theme of the 49th annual convention of the National Electrical Contractors Association to be held at the Hotel Biltmore, Los Angeles, Calif., October 17 to 20.

The Administrative Committee, Labor Relations Committee, Line Constructors Committee and Board of Governors will hold meetings prior to the convention, starting on October 13.

The opening program on October 17 will be conducted by the Los Angeles Chapter, S. F. Hill, president, presiding.

The first session of the annual meeting will follow immediately with Edw. Vanderlinde, president of NECA, presiding. There will be the approval of minutes, reports of staff officers Secretary-Treasurer Clint J. Harder and Executive Vice President P. M. Geary. Then the president's address on "Progress" will be given. This will be followed by report and recommendations of Board of Governors and action on proposed constitutional amendments.

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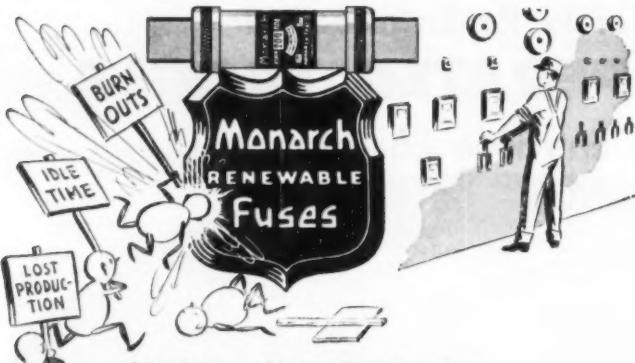
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Committee reports and open forums are scheduled for the second session on Wednesday morning. District Vice President O'Connor will preside. A report on the Management and Technical Personnel Training Committee will be given by Robt. W. McChesney, chairman; Governmental Affairs Committee by L. T. Souder, chairman, and Trade Practice Committee by A. E. Smiley, chairman.

There will be a convention luncheon on Wednesday with Dr. William B. Stratford, Dean of Men, Weber College, Ogden, Utah, as the guest speaker.

On Thursday a closed session will hear "Trends in Labor Relations" by E. C. Carlson, chairman, Labor Relations Committee; "Bargaining Agencies for Line Construction Contractors" by John S. Clark, chairman, Line Constructors Committee; "The Council on Industrial Relations" by Robt W. McChesney, chairman. Also "Problems in Handling Heavy Electrical Equipment" by C. W. Mosley, Charlotte, N. C.; "Opportunities in Line Construction Field" by R. C. Hughes, Spokane, Wash.; "Employees Benefit Program" by Laurence W. Davis, NEBB; "Trade Jurisdiction" by S. J. Cristiano, director, Eastern Region, NECA.

Thursday afternoon will be devoted to the business meeting of IBEW Employers Section NECA with Chairman Carlson presiding; and the annual business meeting of the Line Constructors Section with Chairman Clark presiding. The annual banquet will be

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ELECTRICIAN FOREMAN Ronald E. Mathis checks wiring diagram of equipment in the diesel engine plant of Caterpillar Tractor Co., Peoria, Illinois. With the Company 15 years, Mathis has charge of electrical maintenance crews in the engine plant.

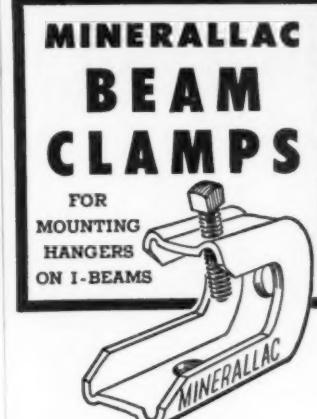
held Thursday evening.

The final session of the annual meeting will be on Friday, October 20. The theme of this meeting is "As Others See Us", and is sponsored by the NECA Business Promotion, Interdependence and Adequate Wiring Committees. The utilities will be represented by R. E. Ginna, vice president, Rochester Gas & Electric Co.; industrial plant management by Carlton B. Tibbetts, president, Los Angeles Steel Castings Co.; the general contractor by Merle E. Smith, treasurer of the T & S Construction Engineers, Inc., Los Angeles; and the electrical manufacturer by Fred Luna, sales promotion manager, Anaconda Wire and Cable Company. This will be followed by "The Electrical Contractor's Services" by H. L. Scott, chairman, Business Promotion Committee; S. C. Sachs, chairman, Interdependence Committee; and A. V. Bartlett, chairman, Adequate Wiring Committee.

IES Meets In Pasadena

The annual National Technical Conference of the Illuminating Engineering Society was held at Pasadena, Calif., August 14-17. It made an advance patrol into some mighty significant future ways and means of lighting as well as checking over what present methods are doing. Highlights from a contractor's and design engineer's standpoint will be briefed here. Charles H. Goddard, Sylvania Electric Products, Inc., president of IES, warned the members to alert themselves to changing times and stringencies that war economy might bring.

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Mounts Minerallac hangers No. 0 to No. 6 on I-beams safely without necessity of drilling holes. Made of heavy gauge zinc plated steel with deep drawn ribs to give needed strength, these durable, light weight beam clamps have 1/4-20 tapped holes—will fit beam flanges up to 1 1/2 inch thick. Furnished with case-hardened set screw. Low cost.

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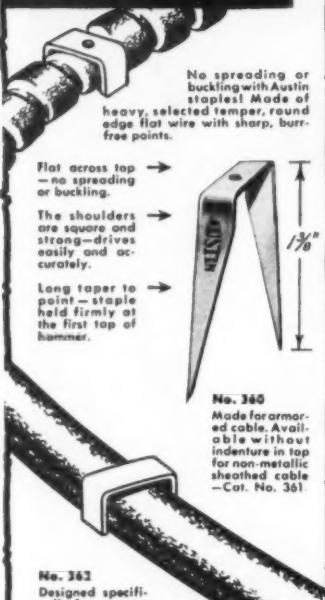
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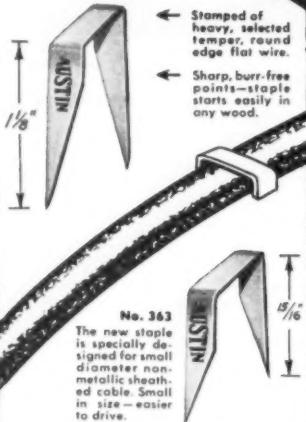
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No. 362
Designed specifically for non-metallic sheathed cable. Made shorter for easier driving.



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The new staple is specially designed for small diameter non-metallic sheathed cable. Small in size—easier to drive.

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CHARLES H. GODDARD, of Sylvania, president of IES, coaches Walter Sturrock, president-elect, on program details at the Pasadena National Technical Conference.

in a laboratory stage, may have far reaching effect on interior lighting and electrical installation. Presenting a paper by Eric Mager, Dr. E. Paine, and Charles Jerome of Sylvania, Dr. E. F. Lowry of that company demonstrated a new condenser plate that glows. Using a new conducting glass by Corning as one side, aluminum foil for the other and sandwiched between in a dielectric some selected fluorescent material, a condenser plate which is transparent is made. When energized with high frequency the phosphors glow. Thus light is produced without first heating a filament or striking an arc. Large areas of low brightness for interior illumination were envisioned with such plates in the future.

Equally spectacular but nearer a production stage was the use of high heat and thermal shock resisting Vycor glass bulbs for lamps that can be used for electric range elements, or for small, compact, reflector type high wattage lamps for sports or outdoor lighting. The range elements would have 1250-or 1500-watt filaments in them in the size of an R-40 reflector lamp. R. G. Slauer of Sylvania demonstrated these lamps at the conference. He followed what was almost like a magic show of new and spectacular glasses by Dr. W. W. Shaver of Corning. For light control the new photosensitive glass, into which egg-crate louvers of small size and even horizontal louvers set at a 30° angle can be photographed permanently, offered the most practical possibilities for immediate use in office and school lighting. Designs photographed into glass offer uses in luminous decorative lighting with either fluorescent or incandescent lamps behind them.

The Progress Report, presented with showmanship and speed by Alston Rodgers, General Electric Co., Lamp Department, Cleveland, paraded the prog-

1 MAN CAN DO THE WORK OF A CREW...

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ELECTRIC
PLANT



Use Electric Tools on Every Job!

Speed the work, cut costs on installation and maintenance jobs. Lightweight Onan air-cooled electric plants supply electric power anywhere for lights, drills, saws, hammers, spades and other motor-driven tools. Equipped with carrying handles or dolly-mounted. Take 'em anywhere and plug in for all the power you need.

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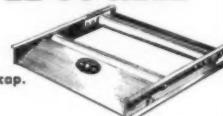
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ing control requirements. It performs dependably, even in sub-zero weather—without the need of special coils or other low temperature protective devices... it can be supplied with an omitting device—an advanced time cut-off—or an astronomic dial for automatic sunset to sunrise operation. The Type W offers all these features, plus a complete electrically-wound mainspring and timing mechanism that takes over immediately in case of a power failure and does not have to be reset after current interruptions. These two types, and all other switches in Sangamo's complete line are available through your electrical wholesaler.

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Now Contains the 1949 supplement to the Code

(Bound-in supplement follows same clear interpretation of Code as rest of Handbook. Book same price with supplement included.)

National Electrical Code Handbook gives rules and requirements of all jobs, what wiring is required to apply them, accordance with the latest National Electrical Code. All rules for a job are grouped in one place. Covers definitions of Code terms and requirements applying to all wiring systems. By A. L. Abbott, 6th Edit., 633 pages, 521 Illus., \$4.00.

2. PRACTICAL ELECTRICAL WIRING

A complete course of instruction for those who want to learn how to do electrical wiring. Beginning with basic principles and methods, to the completion of typical wiring jobs. Covers residential, farm, and industrial wiring methods. Given direct help in passing city and state examinations. By H. Richter, 3rd Edit., 574 pages, 576 Illus., \$8.75.

3. AMERICAN ELECTRICANS' HANDBOOK

Contains hundreds of detailed descriptions, rules, methods, pictures and practical data to help you install, maintain and operate electrical equipment. Includes recent advances in electronic tubes and circuitry, plus industrial applications. By T. Croft, revised by C. G. Moore, 6th Edit., 1734 pages, 1327 Illus., \$6.00.

4. REWINDING SMALL MOTORS

This practical manual shows how to handle all types of wiring jobs—whether hand or machine wound—from start to finish. Provides data on new materials, factory methods, and processes. Covers use of Foneser type insulation on insulated wire, etc. By D. Braymer and A. C. Roe, 3rd Edit., 412 pages, 345 Illus., \$4.50.

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ress in lighting equipment during the past year. Among the multitude of things shown, pictured or told about by Rodgers were: New large reflector lamps for high bay industrial mounting; new hard glass 300-watt R-40; the new deluxe fluorescent lamps; krypton filled lamps; new "black light" blue glass for hot or cold cathode envelopes to pass more u-v; new trigger ballasts and new sequence-start, series-operation, high-power-factor ballasts. Also thin corrugated anti-static plastic that can be rolled up for luminous ceilings, etc.; a translucent material in corrugated sheets made of both plastic and glass fiber; many new louvered silver bowl fixtures and a reflecting dome with metal shield to hide the lamp; commercial fixtures with choice of lenses, plastic plates or louvers; a semi-indirect luminaire that is a plastic tube, half semi-opaque, the upper half clear; variable angle louvers. And a slim-line fixture that can lower channel, lamps and ballast on counterbalanced reels for cleaning and relamping; a packaged lighting system in one unit which unfolds to mount eight slim-lines and cover an 18x10 ft. ceiling area; spot or swivel mountings for attachment to power duct; a line of unit residential valance units to build up to any size window; telescoping lightweight pole and sockets for backyard sports lighting.

Bold use of fluorescent lighting for the home, in long valances or brackets to light whole walls offers a big market for electrical contractors and a break away from the \$7.50 fixture allowance that is the low point in home illumination at present. E. W. Commyer, General Electric Co. Lamp Department, presented two important studies. One on color effects of standard and deluxe fluorescent lamps on standard paint and decoration colors so that



FATHER AND SON combination head The Federle Electric Co., Dayton, Ohio electrical contracting firm. Here, Joseph C. Federle and his son Charles S. check over layout for a high intensity approach lighting installation at Wright-Paterson Field.

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(Patent Pending)

SAVES TIME • SAVES MONEY

- Perfectly designed and engineered to do the work of **two** 2-light 40's.
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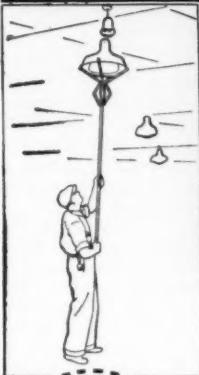
they can be predicted in advance. The other was an averaging of the sizes of people, furniture and lamps and the writing of recipes for lighting in a practical way some 20 home seeing tasks. And this too prescribes valance lighting and long fluorescent wall brackets in many instances.

In fact fluorescent lighting was treated from many angles. From a contractor's standpoint there were: A method for appraising office lighting systems, presented by George J. Taylor, Day-Brite, applies a letter rating system to 18 common types of luminaires on a 50-footcandle basis and gives a cost analysis of each. Louvered ceilings in department stores were accorded many benefits by Robert R. Wylie, Sylvania. Savings are found in air conditioning diffuser equipment, sprinkler treatment, maintenance costs. Intangible benefits come from flexibility. They permit the merchant to accent merchandise and make constant changes in the store.

Many a contractor is acquainted with the "X-Factors" of a job. B. S. Benson, Jr. and E. H. Church of Benjamin recited a familiar list of difficulties experienced. Although carefully laid out, check and double checked, many an installation falls far short of the computed design. The lighting levels expected are not delivered. He analysed these X-factors as variations in performance of individual lamps, ballasts and luminaires, ambient temperature, drafts, line voltage, inadequate calculation data. He suggested standardization of performance of ballasts, photometric tests based on light output of the entire lamp-ballast-luminaire combination, lamps that will deliver peak output higher on the temperature scale and further study of temperature and line voltage on light output of the lamp-ballast-luminaire combination.

Another paper of contractor interest was that on school auditorium and stage lighting, by Carl J. Allen, General Electric Co. Now that classroom lighting is recognized, it is time to do something with auditoriums and stages. He analysed the requirements and offered a list of practical suggestions as to installation and equipment to meet various sized budgets.

Aviation lighting covered everything from the interior of the plane to landings in fog. After showing dramatic movies of the tests with both electronic and lighting aids for landing at Arcata, Calif., the foggiest field in the U. S., H. J. Cory Pearson, chief of the lighting branch, airport division of CAA said, "When they no longer put windows in the cockpit then I'll agree that electronics can do the whole job." W. A. Pennow, Westinghouse, maintained that present lighting equipment



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is inadequate for many medium duty airports, especially in providing greater upward intensity to guide pilots circling the field awaiting landing orders. He showed a range of equipment designed for various uses and incorporating improvements.

The Lighting Service Forum, a feature separate from the IES convention, usually put on by the utility companies, reviews several outstanding lighting sales promotion programs. Under J. S. Walsh, Pacific Gas & Electric Co., San Francisco, the presentation was dramatized as a king sized television set over which the five selected promotion programs were enacted. A. W. Smith, Central Arizona Light & Power Co. showed how dealers and company sell CLM domestic lamps. J. M. Stedman, Pennsylvania Power & Light Co., depicted that company's planned lighting program for schools, stores and offices. T. W. Lauer and R. T. Nadeau, Los Angeles Department of Water & Power, presented the life saving value of modernizing the street lighting. C. C. Shotwell, Philadelphia Electric Co. told of the excellent cooperative lighting sales program that ties in lamp and equipment manufacturers, wholesalers and contractors. Roy E. Dahlin, Southern California Edison Co., illustrated how the company's own example in ahead-of-the-times lighting of its own buildings afforded contractors a place to bring their customers to see a model installation and sell up to one like it.

Dates Ahead

**International Association of Electrical
Leagues—Annual Conference**—Conway Plaza Hotel, Boston, Mass., Oct. 11-14.

National Electrical Contractors Association—Annual convention—Hotel Biltmore, Los Angeles, Calif., Oct. 17-20.

National Farm Electrification Conference—Melbourne Hotel, St. Louis, Mo., October 18-20.

Illuminating Engineering Society—New York Section Northeastern Regional Conference, Hotel Statler, New York, N. Y., October 26-27.

National Electrical Manufacturers Association—Chalfonte-Haddon Hall, Atlantic City, N. J., Nov. 13-16.

American Standards Association—Annual Meeting, Waldorf-Astoria Hotel, New York, N. Y., Nov. 27-29.

Plant Maintenance Show and Conference—Cleveland, Ohio, January 15-18.

International Heating and Ventilating Exposition—Commercial Museum, Philadelphia, Pa., January 22-26.

American Institute of Electrical Engineers—Winter General Meeting, New York, N. Y., Jan. 22-26, 1951.

National Electric Sign Association—Hotel New Yorker, New York, N. Y., February 5-7.

Edison Electric Institute—17th Annual sales conference, Edgewater Beach Hotel, Chicago, Ill., April 2-5.

Chamber of Commerce—29th Annual meeting, Washington, D. C., April 30-May 2.

National Fire Protection Association—Annual Meeting, Detroit, Mich., May 7-11.

Edison Electric Institute—Denver, Colo., June 4-7.

Illuminating Engineering Society—National Technical Conference, Hotel Shoreham, Washington, D. C., August 26-September 1.

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500 VOLTS DC GENERATOR**

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COMMON CAUSE

[FROM PAGE 59]

Live, active local committees are the best vehicle for industry cooperation we can have.

W. T. S.: What is in prospect for current NECA promotion; interdependence, electrical modernization, etc.?

E. V.: I do not believe we ought to do anything to slow down the momentum we already have on these programs. Their objectives are just as important in a mobilization economy if not more so. There is very little in our business that does not contribute one way or another to the improvement of production, to the release of valuable manpower, or to other essential economic values.

W. T. S.: I understand your convention theme this year is "Progress, Through Efficient Management and Training." How will you tie this in with current conditions?

E. V.: It was never more important. Our industry responsibilities are greater than ever. The need for efficient management is vitally important in times like these, and training is necessary to keep pace with the rapid expansion of electrical use and the growing demands for many and new types of electrical applications. A mobilization economy only makes the need for such training more urgent.



ENGINEERS Paul Decker (left) and Ellis M. Steen of Ralph H. Decker, Inc., electrical engineering consultants on the Drake Hotel changeover project in Chicago, inspect concrete "plug" made by hole boring machine used to provide riser openings in the floors.

This Steam-Heated Plant Uses 18 AUXILIARY ELECTROMODE all-Electric HEATERS



Plant of Commercial Controls Corporation, Rochester, N.Y.

ELECTROMODE All-Electric Heaters are the economical answer to heating problems in old and new plants throughout the country. In the plant shown above, use of thermostatically controlled Electromodes supplied fan-circulated warmth to eighteen hard-to-heat areas, saved piping and eliminated expensive enlargement or forced operation of the central steam system. Here is how it was done:



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WASHROOM—Added warmth for showering comfort was provided by one 3 KW Unit.



LOBBY—One 4 KW wall type Electromode overcame poor heating caused by long steam runs.

AUTOMATIC AND NON-AUTOMATIC ELECTROMODES (1.5 TO 45-KW) FOR HOME, OFFICE, INDUSTRY

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Please send catalogs and full technical information concerning Electromode All-Electric Heaters.

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FOR SALE

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1600 Amperes, 3 poles, Inverse Time delay elements in outside legs. Shunt trip only in center leg. Electrically operated, 600 V.A.C. Inverse time elements adjustable from 100-200 per cent. With Reverse current attachment. Totally Enclosed motor, pull start, I.C. 10000 RPM. Rating 500A with Manual operating handle. Used 1 Month on 300 Amp. Feeder. Never opened or closed under load.

Write Kenneth Reuben, Electrician

LINCOLN PARK AMUSEMENT CO.
State Road, North Dartmouth, Mass.

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WANTED

42-inch, air-operated coil spreader One high-voltage tester

WILL SELL 2KW, reconditioned 110-volt AC plants for \$240. Miscellaneous Motor-Generator sets, Rotary Converters and Alternators.

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Mankato, Minnesota

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STORE DISTRIBUTION BY VERTICAL BUS

[FROM PAGE 57]

Ceilings in most sales areas are clean; with 4 x 4-foot recessed fluorescent fixtures used predominantly, set flush with acoustical tile. Soft white 40-watt lamps are used behind eggcrate louvers; 6 lamps installed in first-floor units, 4 lamps in fixtures on other floors. Four of these square units are installed in each 21-foot bay, resulting in an 11-foot spacing in either direction.

Lighting on the 6th and 7th floors is incandescent, with 150-watt downlights recessed on 8-foot centers. With deep, brushed-aluminum bowls and angular-louvered cut-offs, units produce diffuse glareless lighting.

Also used for special purposes are square Holophane 200-watt incandescent units with adjustable sockets, permitting regulation of beam-spread between 30- and 60-degrees, as desired.

The tailoring shop utilizes 8-foot 4-lamp commercial slimline fixtures, suspended by parallel lines of chain hangers. Rigidity is insured by the installation of stiffener plates across the tops of adjacent fixtures, and EMT is used to connect units on the same circuits.

In addition to in-built overhead wall-case lighting and periphery lighting in display counters, swivel spots are ceiling-mounted for accent purposes and floor outlets permit the use of portable lights when desired. All fluorescent units are equipped with high power-factor ballasts.

Trucking Facilities

With an average of 175 trucks making daily deliveries or pick-ups, it was essential that interior loading facilities be provided so that trucks would not obstruct traffic on the city streets. Maximum shipping service with a minimum utilization of space was therefore provided by installing a curved ramp between the street level and a basement loading area. To prevent incoming and outgoing trucks from meeting on this ramp, photoelectric monitors are positioned at the top and bottom. Through this arrangement, a truck entering the building from the street causes a red warning light to flash at the basement end and, conversely, a truck starting up the ramp will activate a sidewalk-located signal. Trucks are turned around at the bottom by means of an electric turntable,

permitting vehicles to back up to the loading platform.

Photocell beams are also used at all street entrances, so that customers entering or leaving the store are automatically added or subtracted by a master counting machine operating on an impulse system motivated by magnetic relays. In this manner, a graphic record is available at all times, indicating the number of persons in the store for any interval.

Automatic relay control is also used in conjunction with the ventilation and sprinkler systems, arranged so that blowers are shut off in the event of sprinkler head operation. Therefore, in the event of fire, lack of draft in the ducts would retard the spread of flames from one floor or department to another. Ventilation ducts, incidentally, are used both for summer cooling and winter heating. All ventilation and heating equipment is electrically operated, with both pushbutton and automatic control. Indicating lamps on the main ventilation control board notifies the engineer of the status of all blowers at all times.

Another electrical store convenience and service is the complete public address system, with flush low-volume speakers mounted in ceilings, columns and partitions. Through the mediums of microphones, record players, carillon bells, a radio pick-up, remote microphone jacks and 3-power high-fidelity amplification, it is possible to broadcast speech or music throughout the store generally or to any desired area.

This department store was planned by architect William P. Day and consulting engineer Clyde E. Bentley. All electrical work was by Lemoge Electric of San Francisco. Construction foreman for Lemoge was Jack Mathieson.



CHIEF ELECTRICIAN J. L. Smith (left) Alpha Portland Cement Co., St. Louis, Mo., takes his maintenance electricians Frank C. Schillinger and George Alles to industrial section meeting of St. Louis Electrical Board of Trade to learn about eddy current couplings.

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We give you immediate delivery and rock-bottom prices on

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Write today for information on
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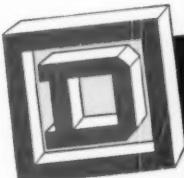
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HERE COMES TROUBLE

ON THAT BID WE MADE THURSDAY!



HERE, TAKE YOUR ESTIMATE... WHY SHOULD THE WIRING FOR OUR HOUSE BE SO HIGH? THE BROWN'S HOME IS LARGER, YET THEY'RE PAYING LESS!

THAT'S RIGHT, DEAR.

BUT, MRS. HARRIS, YOU'LL REMEMBER WE TALKED ABOUT ADEQUATE WIRING FOR YOUR HOME. THAT'S IMPORTANT.

YES, BUT HOW IMPORTANT?

IT MEANS A LOT TO YOU, MRS. HARRIS. ADEQUATE WIRING MEANS MORE COMFORT IN YOUR HOME... EFFICIENT OPERATION OF APPLIANCES... PLENTY OF SWITCHES AND OUTLETS TO HANDLE EVERY ELECTRICAL NEED.

I'M BEGINNING - TO UNDERSTAND WHY IT DOESN'T PAY TO SKIMP. YOUR STORY MAKES SENSE.

HERE'S SOMETHING ELSE, MRS. HARRIS... WE USE ONLY HIGH-QUALITY WIRING MATERIALS... YOUR ASSURANCE OF LASTING SERVICE, CONVENIENCE AND DEPENDABILITY.

THE GENERAL ELECTRIC NAME IS FAMILIAR TO ME... WE'VE COME TO REALIZE WHAT G-E PRODUCTS MEAN IN OUR HOME.

YOU KNOW, THE COMBINATION OF ADEQUATE WIRING AND QUALITY MATERIALS LETS ME SEE THIS IN A NEW LIGHT... I THINK WELL BE ABLE TO DO BUSINESS.

I'LL BE AROUND IN THE MORNING... GOOD-BY, MRS. HARRIS... GOOD-BY MR. HARRIS.

HERE, PHONE THE G-E DISTRIBUTOR AND ASK HIM TO GET THIS READY FOR US. TELL HIM THERE'S TO BE NO SUBSTITUTE FOR G-E MATERIALS ON THIS JOB... THEY WERE THE CLINCHER, BECAUSE THEY STAND FOR "QUALITY" IN EVERYBODY'S LANGUAGE.

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